# NUEXCO

**NOVEMBER 1982** **NUMBER 171**

# Monthly Report on the Nuclear Fuel Market

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# EXECUTIVE SUMMARY

**Exchange Value $17.50. 50 Cent Increase First in Four Years**

The **Exchange Value** as of October 31, 1982 is $17.50 per pound $U_3O_8$. The spot and near-term markets were unusually active for the fifth consecutive month. Nine uranium sales are reported, involving a total of 1.4 million to 3.0 million pounds $U_3O_8$ equivalent.

**Near-term Supply and Demand Both Increased Significantly**

*Active* sellers in the zero to one year time frame are offering 4.3 million pounds $U_3O_8$, up from 3.3 million pounds last month. Even after spot and near-term transactions representing more than one million pounds were concluded during October, *active uranium demand* more than tripled to 2.1 million pounds $U_3O_8$ as of the end of the month.

**Near-term Supply-Demand Imbalance Eased**

The ratio of near-term supply to near-term demand declined to 2.1:1 this month, less than half last month's ratio of 5.0:1.

**Transaction Value Declined $0.30 to $17.00**

The **Transaction Value** as of October 31, 1982 is $17.00 per pound $U_3O_8$. It includes 20 transactions totaling 3.6 million pounds $U_3O_8$ and covers a period of three months.

**Conversion Value Rose Fifty Cents to $1.60**

The **Conversion Value** as of October 31, 1982 is $1.60 per pound U as $UF_6$, up fifty cents from last month. No conversion transactions are reported. Active sellers are offering 1.7 million pounds U as $UF_6$ in near-term conversion services, about the same as last month. While active demand more than tripled, it still amounts to only 320 hundred thousand pounds $UF_6$.

**Africa**

Third quarter production figures for **South Africa** show a 5 percent increase over the second quarter. The IAEA granted full membership to the UN Council for **Namibia.**

**Australia**

Analysis of ERA's first annual report indicates Ranger production cost was approximately A$23.25 per pound $U_3O_8$. Australian government chose Urenco-Center gas centrifuge technology as basis for studying feasibility of domestic enrichment.

**Canada**

Saskatchewan government has repealed its regulation requiring that the province be offered up to 50 percent equity in any new mining venture.

**Europe**

In **France** there is concern that the nation's ninth five-year plan will call for substantial cutbacks in the nuclear power construction program.

In **Spain** the socialists' recent election victory may jeopardize the country's present nuclear program.

**Far East**

**People's Republic of China**, Canton Electric and China Light and Power have made a "decision in principle" to proceed with the Canton-Hong Kong nuclear power project.

In **Japan**, ANRE comparative estimates of electricity generation costs show substantial advantage for nuclear power, primarily due to Japan's having kept length of construction cycle under control.

**United States**

Number of uranium properties being offered for sale has increased sharply in recent months, but the few potential buyers are being very selective.

**Market Analysis**

Nuexco's brokerage experience indicates that the availability of the Variable Tails Assay Option has encouraged the existence of an active secondary market in SWU.

**Raw Materials**

Describes uranium occurrences in Finland.

**Figures of the Month**

Has been moved to the reverse side of this **Executive Summary** and has been expanded to include numbers relevant to SWUs and enriched U.

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*FIGURES OF THE MONTH*

| | This Month | Last Month | 12 Months Ago |
|---|---|---|---|
| | | (Referenced to October 31, 1982) | |
| Exchange Value[1] | 17.50 | 17.00 | 23.50 |
| Transaction Value[1] | 17.00 | 17.30 | 24.10 |
| Conversion Value[2] | 1.60 | 1.10 | 1.10 |
| Loan Use Charge Rate[3] | 6% | 6% | 5½% |
| Near-Term Uranium Supply[4] | 4.3 | 3.3 | 8.7 |
| Near-Term Uranium Demand[5] | 2.1 | 0.66 | 4.3 |
| Near-Term Supply-Demand Ratio | 2.1 | 5.0 | 2.0 |
| Current Transactions[6]: | | | |
| Number of Transactions | 9 | 7 | 5 |
| Quantity of Material[7] | 1.4-3.0 | 0.8-2.0 | 1.0-2.1 |
| USDOE SWU Prices[8]: | | | |
| AFC | 138.65 | 138.65 | 130.75 |
| Requirements | 149.85 | 149.85 | 119.00 |
| Optimum Tails Assay[9] | .341 | .346 | .306 |
| Calculated Price of Enriched $UF_6$[10] [11]: | | | |
| 2.5 w/o $U_{235}$ | 668.30 | 657.50 | 708.05 |
| 3.0 w/o $U_{235}$ | 865.68 | 852.53 | 911.10 |
| 3.5 w/o $U_{235}$ | 1,067.20 | 1,051.70 | 1,118.06 |
| 4.0 w/o $U_{235}$ | 1,271.79 | 1,253.94 | 1,327.91 |

---

[1] US $ per pound $U_3O_8$ equivalent

[2] US $ per pound U as $UF_6$

[3] Per annum

[4] Active inquiries to sell, for delivery within 12 months after contract signing (millions of pounds $U_3O_8$)

[5] Active inquiries to purchase, for delivery within 12 months after contract signing (millions of pounds $U_3O_8$)

[6] Uranium transactions only; does not include loans, conversion, or SWU transactions

[7] Millions of pounds $U_3O_8$, equivalent

[8] US $ per SWU

[9] Percent $U_{235}$.

[10] Theoretical calculation based on Exchange Value, Conversion Value, 0.20 percent tails assay and the USDOE price for AFC SWUs.

[11] US $ per KgU as $UF_6$

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# MONTHLY REPORT ON THE URANIUM MARKET

November 1982 No. 171

R. WESLEY MILLER, *EDITOR*

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## FOREWORD

Nuexco will host a hospitality suite during the Atomic Industrial Forum's Annual Conference 1982. The suite will be at the Washington Hilton in Washington, D.C., November 14-17. We look forward to seeing you there.

* * *

Nuexco is pleased to advise Subscribers of the elections of J.R. (Bob) Wolcott as Chairman and Chief Executive Officer, and George White, Jr. as President.

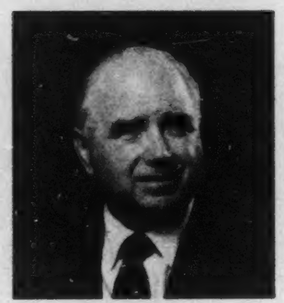
Bob Wolcott has been associated with Nuexco since its inception, serving as a Director since 1968 and as President since 1977. Since 1968, Bob has also headed his own consulting firm specializing in strategic planning for the nuclear industry. Bob has been in the nuclear business since the very beginning, having been the design manager for Dresden Unit 1, the first commercial BWR built in the US. Bob also held a variety of positions in engineering and international marketing with the General Electric Company's nuclear division.

George White, Jr. joined Nuexco in 1971 as Marketing Manager. He was elected a Vice President in 1972 and Senior Vice President and a Director in 1979. Before joining Nuexco, George was associated with the investment banking firms of Stone & Webster and Drexel Harriman Ripley in New York City.

Wayne D. Fowler has also been elected a Director joining George, Bob, Don Allen and Jules Pearlman as members of Nuexco's Board of Directors. Wayne joined Nuexco in 1975 as a Vice President, having previously been associated with General Atomic in San Diego.

Nuexco's continued growth has led to a geographic expansion which now includes offices in New York City and Europe, managed respectively by Ken McCue and Jim Vaughan. Menlo Park brokerage operations are managed by Wayne Fowler and a planned Atlanta office will be managed by Jerry Reaves.

The restructuring of the firm during the past year, combined with our existing network of representatives and consultants, is designed to provide our clients with increased and more timely access to Nuexco's full resources.



*Bob Wolcott*

*George White, Jr.*

*Wayne Fowler*

NUEXCO

November 1982
#171

## *MARKET ACTIVITIES*

### PRICING

The **Exchange Value** as of October 31, 1982 is $17.50 per pound $U_3O_8$, up fifty cents from last month. During October, the spot and near-term markets were unusually active for the fifth consecutive month. The *Market Data* section lists nine uranium transactions this month, involving a total of 1.4 million to 3.0 million pounds $U_3O_8$ equivalent.

* * *

*Active uranium supply* (material offered at competitive prices, terms and other conditions) amounts to 4.3 million pounds $U_3O_8$ in the near term, an increase of one million pounds since last month. Even after spot and near-term transactions representing more than one million pounds $U_3O_8$ were concluded during the month of October, *active uranium demand* more than tripled to 2.1 million pounds $U_3O_8$ as of the end of the month. Therefore, the *supply-demand ratio* declined to 2.1:1, less than half last month's level of 5.0:1.

* * *

The **Transaction Value** as of October 31, 1982 is $17.00 per pound $U_3O_8$, down $0.30 from a month ago. The current Transaction Value includes 20 transactions totaling 3.6 million pounds $U_3O_8$ and covers a period of three months. The time lag built into Transaction Value was very evident, as it continued the decline of recent months, reaching a level equal to the previous two months' Exchange Value.

* * *

The **Conversion Value** as of October 31, 1982 is $1.60 per pound $UF_6$, up fifty cents from a month ago, but the market remains very thin. Active offers to sell conversion services in the near term amount to approximately 1.7 million pounds U, about the same as last month. Although *active conversion demand* more than tripled, it still amounts to only 320 thousand pounds U. Nevertheless, there is a consensus that the price required for secondary market transactions is once again substantially higher than last month.

* * *

The **Loan Use Charge Rate** remained at six percent per annum. Some discussions are taking place and one transaction is reported, but the loan market is generally quiet.

* * *

This month's three percent increase in the Exchange Value should be viewed in the perspective of market events during the first ten months of this year. Last year ended with the Exchange Value at $23.50 per pound $U_3O_8$, having been at that level for six months. Prices appeared to have bottomed. However, renewed and aggressive selling developed as a result of several factors, including cancellations and delays of nuclear facilities, continued overproduction, growing inventories, high interest rates and litigation. The January 31, 1982 Exchange Value dropped to $23.00, setting in motion a sustained 28 percent decline, which saw the Exchange Value reach $17.00 by the end of August.

Nuexco is aware of at least seven entities, each of which has sold during 1982 more than 1,000,000 pounds $U_3O_8$ for spot or near-term delivery. Sellers included utilities and producers, as well as US and non-US entities. While essentially completed now, those sales campaigns were marked by aggressive pricing and led to sales of more than 10 million pounds $U_3O_8$. With that sort of pressure being exerted on the spot and near-term markets, it is not surprising that the Exchange Value declined to $17.00.

Because the current increase in the Exchange Value is the first to occur since November 1978, there is a tendency to assume that prices have bottomed out and a reovery is underway. The prospect of a US embargo on the import of non-US origin uranium may have contributed to this month's price rise by altering the perceptions of some market participants. On the other hand, the embargo issue and the current firming in prices may be more a coincidence of timing than cause and effect; the embargo issue first surfaced in early 1982 when the Exchange Value was well over $20.00 per pound $U_3O_8$. Nevertheless, regardless of whether they turn out to be accurate, market perceptions can be self-fulfilling *in the short term*.

For the long term, however, it would be imprudent to ignore certain basic and very powerful market factors. The inventory redistribution so necessary for any semblance of balance between supply and demand is far from complete. While some utilities and producers have liquidated excess stocks, others could become sellers at any time, particularly if prices seemed to be firming.

It must also be observed that much of the purchasing currently taking place is discretionary, and such demand could well vanish in the face of higher prices. Utilities willing to increase inventory at what they view as bargain prices will likely withdraw if prices rise sub-

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stantially. Similarly, producers who are purchasing rather than producing can and will produce when the economics of the "make or buy" decision change.

Furthermore, the basic production-consumption equation is out of balance and gives every indication of remaining so for several more years. Production continues at a rate of 110 million pounds $U_3O_8$ annually. Consumption, though rising, is still only about 60 million pounds annually. It is difficult to develop a case for a strong price recovery under such conditions.

Thus, while current perceptions could lead to price recovery in the near term, market participants would be well advised to bear in mind those market factors that have too often been ignored in the short history of the commercial uranium market. The fundamentals of supply and demand can be ignored only at great economic risk.

## AFRICA

Production figures from South Africa gold-uranium operations for third quarter 1982 and year-to-date are presented in Table 1.

**Table 1**

**REPUBLIC OF SOUTH AFRICA:**
**Production from Gold-Uranium Operations**
**(Thousands of Pounds $U_3O_8$)**

| Operation | 3 Q 82 | YTD |
|---|---|---|
| Beisa (St. Helena) | 149 | 404 |
| Blyvooruitzicht | 127 | 444 |
| Buffelsfontein | 315 | 955 |
| CHEMWES | 376 | 992 |
| Dreifontein Consolidated | 129 | 383 |
| ERGO | 141 | 431 |
| Harmony | 329 | 971 |
| Hartebeestfontein | 226 | 694 |
| J.M.S. | 457 | 1,538 |
| Randfontein | 271 | 747 |
| Vaal Reefs | 1,062 | 2,801 |
| Western Areas | 105 | 263 |
| Western Deep Levels | 94 | 290 |
| TOTAL: | 3,781 | 10,913 |

Third quarter production of 3.8 million pounds $U_3O_8$ represents a 5 percent increase over the second quarter total of 3.6 million pounds $U_3O_8$. Some comments on experiences of individual production operations during the third quarter:

1. The Beisa section of St. Helena made an operating profit for the first time. Third quarter operating income, including that from gold as a by-product, amounted to R 4,862,000.

2. Despite a 5 percent increase in tons treated, Blyvooruitzicht production dropped 17 percent due to a 21 percent drop in grade from 0.326 to 0.258 pounds $U_3O_8$ per ton. Despite the fall in production, the irregular timing of sales produced a 23 percent rise in profits.

3. CHEMWES production increased 34 percent due to an 11 percent increase in throughput and a 20 percent increase in grade, to 0.397 pounds $U_3O_8$ per ton.

4. At Randfontein, the new solvent extraction plant is operating at design efficiency. That, combined with higher throughput, yielded a 17 percent increase in production.

5. At Vaal Reefs, the 8 percent production increase was due to a 10 percent increase in grade, to 0.507 pounds $U_3O_8$ per ton.

6. Western Areas reached agreement with their long term customer, allowing the advancement to 1982 of certain sales scheduled for 1983. A substantial cash flow benefit resulted.

* * *

The United Nations (UN) Council for **Namibia** has been accepted into the International Atomic Energy Agency (IAEA) as a full member. This development is controversial on three levels:

1. It can be regarded as one more step along Namibia's road to independence, since the Republic of South Africa will no longer represent Namibia in an important, at least for uranium matters, world political organization.

2. It introduces a new level of politicization to the IAEA. Since South Africa does not recognize the United Nations Council for Namibia, its admission to the IAEA is tantamount to a political repudiation of South Africa's policies in the region.

3. It may cause trouble for Rossing Uranium and its owners, principally Rio Tinto Zinc (RTZ). The Council has repeatedly demanded that RTZ cease "plundering" Namibia's uranium resources. In fact, the chairman of

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the UN Council's delegation to the IAEA meeting, Mr. Starcevic of Yugoslavia, predicted renewed attempts along those lines.

The vote to admit the UN Council to the IAEA was far from unanimous. Some members objected on the grounds that the UN Council for Namibia did not satisfy the specified IAEA requirements for statehood. Some argued that the move would jeopardize the delicate negotiations presently under way on Namibian independence.

It is not yet clear whether this development will have any commercial impact. In the unlikely event that the UN Council succeeded in interrupting or even terminating uranium exports from Rossing, the world's largest single uranium production center, the effects on Rossing's owners and employees could be substantial. On the other hand, a uranium market in which annual production presently exceeds annual consumption by 80 to 90 percent would adjust quite easily in the long run. Some short term effects on the spot market might occur, if any of Rossing's customers felt the need to replace those deliveries with spot purchases. However, the chances of that happening are slight, as Rossing's customers all have ample inventories.

## AUSTRALIA

The Australian government took a further step towards a deeper involvement in the nuclear fuel cycle. It accepted the recommendations of the Uranium Enrichment Group of Australia (UEGA) to use the Urenco-Centec gas centrifuge technology as the basis for studying the feasibility of an Australian enrichment plant. The UEGA recommendations have narrowed down the choice of sites for the plant to either Adelaide or Brisbane. Moreover, the Government approved further studies and set the foreign investment limit at 50 percent (25 percent for uranium projects).

UEGA, comprising four big resource development companies [BHP, CSR, Western Mining Corp. (WMC) and Peko Wallsend] will commence its A$5 million study as soon as the agreement with the enrichment technology holder is finalized. The plant, if built, may commence with an annual capacity of not less than 200,000 SWU in 1992 and, depending on markets, could reach 1 million SWU by 1997.

To gain a clearer view of the likely demand for Australian enrichment services even at this early stage, UEGA and Urenco will carry out a six-month joint market survey as the first phase of the feasibility study.

A variety of political and economic considerations lie behind the UEGA plans:

1. Federal policy calls for upgrading any raw material to the highest possible value prior to export. For farsighted and talented corporations with significant uranium interests (WMC is a majority partner in the Yeelirrie and Roxby Downs projects; Peko Wallsend owns 31 percent of ERA, which owns the Ranger Mine; CSR owns the Lakeway and Honeymoon projects) this policy presents an important opportunity demanding serious exploration of its potential. Australia's huge uranium resources have encouraged strong Federal support for the enrichment project.

2. The Government's policy is designed for the long term and seems impervious to current market weakness and the pockets of anti-nuclear sentiment in the electorate.

3. The discovery of the very large Roxby Downs deposit has generated the hope for long-term improvements in the industrial base of South Australia. This prospect has motivated the South Australian state government to mount, for several years now, a strong political campaign in favor of enrichment in the face of heavy opposition. The political risk is high even now, as a solitary opponent to uranium development holds the balance of power in the state Parliament. Nevertheless, the Liberal Party state government has openly proclaimed their state as a suitable plant site.

4. With rising unemployment in Australia, job creation is thought to be the main theme in the coming state and federal elections. Therefore, they reason, federal support is likely to lean in the direction of the weakest Liberal State Government.

Although UEGA has limited the site choices to Adelaide and Brisbane, the Northern Territory Government has entered its bid in the stakes for the plant site. Their main argument is the higher degree of community acceptance in the Northern Territory for uranium extraction and processing which, in their view, will eventually outweigh the higher construction and infrastructure costs prevailing in that part of Australia. Political as well as environmental constraints, including water supply, will dictate the ultimate choice of site.

UEGA's technology choice after months of study has certainly cleared the air. It requires the group to follow through by considering also the subsidiary question of how best to provide $UF_6$ conversion services to its potential enrichment customers. As a first priority, however, UEGA will explore the attitudes of utilities to an Australian enrichment option.

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## *MARKET ACTIVITIES*

Energy Resources of Australia (ERA) has released its first annual report, covering the operations of their Ranger Mine from October 1, 1981 to June 30, 1982. ERA announced an after-tax profit of A$37.9 million.

Producing 5.9 million pounds of $U_3O_8$, the mill's only teething trouble was with adherence of protective rubber linings on equipment which treats acidic material. In-fill drilling has increased Ranger's uranium resource at No. 3 ore body significantly (proven and probable ore combined). Ranger's present reserve position is summarized in Table 2.

**Table 2**

**RANGER'S RESERVE POSITION**

| Total Ore Reserves[1] | Million Tonnes Ore | Grade (% $U_3O_8$) | Tonnes $U_3O_8$ |
|---|---|---|---|
| July 1981 | 34.5 | 0.243 | 95,978 |
| July 1982 | 51.0 | 0.247 | 125,835 |
| Increase | 16.5 | 0.004 | 29,857 |
| **No. 3 Ore Body** | | | |
| July 1981 | 23.6 | 0.182 | 43,100 |
| July 1982 | 35.2 | 0.207 | 72,838 |
| Increase | 11.6 | 0.025 | 29,738 |

[1] Includes stockpiles

An Australian firm of investment analysts published an income and expense statement after analyzing the ERA accounts. Nuexco analyzed the statement further, resulting in the data presented in Table 3.

Three brief comments:

1. Although direct operating costs amount to only A$6 per pound, the after-tax profit of A$37.9 million represents less than a 9 percent return on capital and capitalized interest of A$431 million.

2. Like every other uranium producer, Ranger could not survive at current spot market price levels. Interest costs — the single largest cost item — would have to fall by 75 percent before Ranger would break even at current E.V. (before repayment of project loans).

3. Assuming annual cost increases of 10 percent (other than interest) Ranger's total costs per pound $U_3O_8$ would reach the level of the current Australian floor price in 4.5 years. The current floor price is approximately double current spot market prices.

* * *

## CANADA

The provincial government of Saskatchewan has repealed the regulation requiring that the province be offered up to 50 percent equity interest in any new mining venture. It was under this regulation that Saskatchewan Mining and Development Corporation (SMDC) acquired its existing interests in the Key Lake and Cluff Lake deposits.

Repealing of the provincial regulation still does not affect the Canadian federal requirement that Canadian companies own at least two-thirds equity in producing uranium deposits. However, it does enhance the probability that new Canadian investors will be attracted to Saskatchewan and thereby increases the likelihood that areas such as Dawn Lake and Midwest Lake will be developed.

Eldorado now owns 100 percent interest in Rabbit Lake and the other previously owned Gulf deposits, and SMDC owns interests in Key Lake and Cluff Lake. As both Eldorado and SMDC are government entities, the majority of the uranium produced in Saskatchewan is now being produced by companies which pay neither taxes nor royalties to the province. Therefore, it is not surprising that Saskatchewan would welcome the introduction of new taxpayers into the province. In this regard, it might be timely for the Canadian authorities to re-examine the federal ownership requirements as well.

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## Table 3

## ANALYSIS OF ERA ACCOUNTS
**(Year ending June 30, 1982)**

| | Millions of A$[1] | Millions of Pounds $U_3O_8$ | A$ Per Pound $U_3O_8$[5] |
|---|---|---|---|
| A. Distribution of Production and Revenues: | | | |
| Shipments under contracts[2] | 117.1 | 3.4 | 34.44 |
| Return to government stockpile[3] | 28.9 | 1.1 | 26.27 |
| Inventory on hand | — | 1.4 | |
| Other income[4] | 4.2 | — | |
| TOTAL: | 150.2 | 5.9 | 32.44 |
| B. Expenses | | | |
| Direct operating costs | 27.2 | | 6.04 |
| Depreciation + amortization | 16.6 | | 3.69 |
| Interest | 48.0 | | 10.67 |
| Royalties[6] | 8.2 | | 1.82 |
| Rehabilitation | 3.3 | | 0.73 |
| Other | 1.3 | | 0.29 |
| | 104.6 | | 23.24 |
| Profit before tax | 45.6 | | 10.13 |
| Taxation | 7.7 | | 1.71 |
| | 37.9 | | 8.42 |

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[1] Because it is difficult to relate prices to US dollars without full disclosure as to when shipments were brought into account, the dollar amounts have not been converted into US currency.

[2] [3]The Company did not publish shipments or prices. It is estimated that the shipments brought to account are as follows:
[2]Overseas contracts: 3.4 m. lb. @ $34.44 = A$117.1m
[3]Stockpile replacements to Australian Government: 1.1 m. lb. @ $26.27 = A$28.9m.
TOTAL: A$146.0m.

[4] Other income includes: interest received ($1.7m) and exchange gains ($2.5m).

[5] ERA does not attribute to material held in stock any royalties, headquarters overhead, or interest expenses. Stockpiled material has been included in the working capital account. Therefore, expenses, total revenues, and profits are allocated to 4.5 million pounds, the amount shipped plus that returned under government contracts.

[6] Royalties cover both payments to Governments and Aboriginal interests.

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*MARKET ACTIVITIES*

## EUROPE

Last month, Report 170 presented excerpts from some of the speeches delivered at the Uranium Institute's annual symposium. This Report will present excerpts from the comments of Dr. Klaus Peter Messer of Rheinisch-Westfaelisches Elektrizitaetswerk AG (RWE), giving a consumer's viewpoint on the uranium market. All of the speeches presented at the symposium will be published by the Uranium Institute in due course.

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**Dr. Klaus Peter Messer** **A Consumer's Viewpoint**
**RWE** **(Relative to Market Stability)**

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We need . . . stability [of the market] — though there may be differences of opinion as to what the phrase means. We need a high degree of security of supply. And the market also needs security of demand.

There are several factors which are important for market stability — or better, "instability"— but the most important is probably the forecasts which are published from time to time, . . . For the year 2000, total capacity changed from a predicted 2,300 GW in 1975 to 700 GW in 1982. This is the main reason why the market has not functioned as well as it should; . . .

. . . the so-called spot price should not be taken as the true uranium price in long-term contracts. . . But there is a relationship between spot and long-term market prices, . . . The spot price can 'pull' the long-term market price, with a force which depends on the magnitude and tempo of the change in the spot price. When it changes very fast it pulls the long-term price all the harder.

By comparing the average spot price over a number of years with what we know was the average long-term market price in the European market, we have succeeded in synthesizing a calculated long-term price, based on an adjusted spot price, which is in remarkable agreement with the actual trends. This seems to indicate that the pulling theory may be correct and we, therefore, now introduce something in our long-term contracts to reflect this feeling. However, when we did the same for the US market . . . the formula gave much poorer agreement. So I have no generally applicable solution to offer, at least one with the required accuracy.

There are, of course, other factors at work. If we compare the proportion of spot sales or purchases in Europe and in the United States, there is a noticeable difference. . . It highlights differences of philosophy between the US and Europe regarding long-term security of supply. We in Europe have a tendency to secure our needs of uranium with long-term contracts, which of course can then leave us unable to buy when spot prices fall. While at the present time this may seem regrettable, I am sure that someday this attitude will be seen to have its advantages, because the spot [price] curve will quite certainly reverse and start rising again.

That is our main worry. I hope that this does not happen at a time and on a scale which will seriously hurt us. One danger is that at times when the market is as depressed as it is now, developments like exploration and installing new production come to a halt. This has to be seen against the certainty that we shall have a doubling of demand in the coming years. There are so many power stations under construction that I fear that the market will not be able to provide the degree of security of supply which we need.

* * *

In **France**, the ninth five-year plan is being formulated. The basis for the plan has been adopted by the Council of Ministers and has been sent forward to the National Plan Commission. The final version will appear in the spring of 1983.

The Plan's Energy Committee is working on forecasts of energy consumption in the 1990s which are substantially lower than those in the Hugon Report which the government used at the time of the Parliamentary debate on nuclear energy in October, 1981. At that time, approval was given for construction starts on six reactors (one unit of 900 MWe and five of 1300) during 1982-83. Approval was based on a forecast of economic growth in France of 5 percent per annum for 1981-90. However, growth was only 0.2 percent in 1981, will be around 1.5 percent in 1982 and about 2 percent in 1983. The result has been a dramatic fall in energy use, which was aided by the success of the government's energy conservation measures. It is interesting to recall that three years or so ago, the Barre Government forecast electricity needs of 460 billion KWH in 1990. The Socialist government has revised this down to 415 billion KWH and some experts now predict around 375 billion KWH.

Rumors have been circulating in French newspapers for the past month that, instead of authorizing the start of construction on six nuclear reactors in the 1984-5 period, the government will reduce this number by half. The Energy Ministry has formally denied that the government has taken any decision on the possible

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## MARKET ACTIVITIES

slowing down of the French nuclear program. No decision will be taken until the beginning of next year.

It has long been recognized that there are strong opponents of nuclear power in the French Socialist government. The Communist Party, on the other hand, is in favor of nuclear power — not least for the employment opportunities that it offers. Approximately 200,000 people are directly engaged and about one million if ancillary activities are counted.

Apart from the slowdown in energy consumption, the financial stringency measures being taken by the Socialist government lend support to the possible cutbacks in high cost nuclear power construction. A third reason lies in the financial deficits of Electricite de France (EdF). It is no secret that the French franc devaluations have increased EdF's financial burden in the servicing of its substantial medium and long-term borrowings abroad. In addition, EdF has not been allowed for some time to apply the rate increases it has sought. A cutback in nuclear plant orders would be quite a relief to EdF.

If France's nuclear power construction program is slowed, the economic effects could be substantial. For example, Framatome, the French reactor supplier, would be severely affected. To reduce the rate of nuclear plant ordering from 2½ units per year to 1½ units would mean an effective reduction of 40 percent in Framatome's domestic business. Also, non-French suppliers would be affected. It is not clear what effect such a move would have on France's numerous uranium interests in Africa, Canada, Australia and the US, but it is clear that France's national uranium requirements would not rise as rapidly as presently expected.

* * *

On September 30, official authorization was given for two 1275 MWe reactors to be built at Nogent-Sur-Seine in the Aube Department. Onstream dates are planned to be 1987-88.

On October 11, official authorization was given for the construction of Chinon B3 and B4, two 925 MWe PWRs in the Indre and Loire Department. Onstream date is expected to be 1986.

* * *

In 1981, EdF's average capacity figure was 63 percent. In 1980, it was 69.6 percent. In August of this year, it was 44 percent (49 percent in June and 50 percent in July). Although the summer is the traditional period for programmed shut-downs, there have been a large number of small incidents necessitating shutdowns — in August, at Fessenheim 1 and Bugey 2. It is likely, therefore, that for 1982, EdF's capacity factor will be below the world average of 60 percent.

* * *

In **Spain**, the socialists' recent election victory may jeopardize the country's present nuclear program. The socialists' leader, Felipe Gonzalez, made the Lemoniz nuclear unit a prominent target in his campaign. The controversy over management of Lemoniz was thought to have been resolved by governmental agreement to accept most of the responsibility for the unit's safe construction and operation. However, during the campaign, Gonzalez called for a regional referendum on the Lemoniz station. His reopening of the issue casts serious doubts on the future of the plant.

The socialists' plans call for reducing the present construction plan by more than 4,000 MWe. Various pretexts are being cited as the basis for the proposed cutbacks; among them are reduced load growth forecasts and vulnerability to flooding. Socialist plans also call for switching all planned nuclear units to coal-fired plants instead.

The ultimate result is not yet clear. However, the Spanish utilities, led by their industry association, Unesa, have reacted strongly against the socialists' announced plans. Their principal arguments have been:

1. Nuclear power is safe and costs less than other forms of energy.
2. The socialists are manipulating energy use forecasts for their own political reasons.
3. To cut the nuclear construction program would threaten 20,000 jobs.

### FAR EAST

The **People's Republic of China**, Canton Electric and China Light and Power have made a "decision in principle" to proceed with the Canton-Hong Kong nuclear power project. Although decisions have not been made as to the supplier or form of purchase and project organization, a site has been selected approximately 40 miles north of Hong Kong. Two 900 MWe units are to be constructed. Cost is estimated at approximately $4 billion. Completion of the first unit will probably be in the early 1990s, with the second to follow a year or two later.

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## *MARKET ACTIVITIES*

China Light and Power will purchase 40 percent of the output for its Hong Kong customers. Ownership will be 95 percent PRC and 5 percent China Light and Power. China Light and Power reduced its planned equity participation from the former 40 percent because of various political uncertainties. Both the PRC and China Light and Power believe the latter should have at least a token equity interest so the people of Hong Kong will be involved in the project.

The preferred plan of organization is a UK turbine generator, a Westinghouse nuclear steam supply system (NSSS) and an American architect-engineer (A-E). However, this plan is fading because of slow progress in negotiations for a bilateral safeguards agreement with the US. Those negotiations were proceeding well for a time, but have recently slowed. Although the Chinese hope the situation will improve after the US elections in November, they are becoming increasingly discouraged with prospects for a bilateral agreement with the US. Failing that, a French vendor may be the only practical alternative. That outcome appears to be the most likely, even if it is not the preferred one.

A major problem is resolution of the project management organization. The PRC wants to handle project management, or be deeply involved in some way, even though the project may cost more as a result. The aim is to gain experience for use on subsequent projects. The UK is pushing to provide essentially a turnkey plant with a Westinghouse NSSS. The French are pressing to provide a turnkey plant and a comprehensive fuel supply plan including enriched uranium. Neither project approach is desired by the PRC. The grand plan of the PRC is to build ten large plants of approximately 1,000 MWe each and ten of approximately 300 MWe each. The large plants would be LWRs; the smaller ones would use the indigenous design being developed by the PRC.

* * *

**Japan**'s Agency of Natural Resources and Energy (ANRE) has published its preliminary estimates of comparative costs for construction and electricity generation using different energy sources. The estimates, for power plants commencing operations in 1982, have been converted from yen to US dollars and are summarized in Table 4.

**Table 4**

**ANRE ESTIMATED COMPARATIVE COSTS FOR ELECTRICITY GENERATION**

| Energy Source | Construction Cost ($ per KWe) | Generation Cost (mills per KWh) |
|---|---|---|
| Oil | 485 | 75 |
| LNG | 635 | 71 |
| Coal | 745 | 56 |
| Nuclear | 1,010 | 45 |

The absolute values of the figures presented in Table 4 are much less important than their relative values. The most important conclusion to be drawn from the data is:

In a country where societal and political objections are resolved in a civilized fashion, it is possible to realize the potential economic benefits of nuclear power. Even though nuclear's unit cost of construction is the highest of the four sources listed, its unit cost of generation is 20 percent below that of coal, the next lowest generating cost.

Why the clear advantage to nuclear power in Japan, when cost comparisons in the US are not nearly so decisive? Because the construction cycle in Japan averages five or six years. That allows utilities in Japan to predict and control their interest costs.

An example of the way things are done in Japan might illustrate the point. The second public hearing for TEPCO's Kashiwazaki Units 2 and 3, initially scheduled for September, will be delayed until sometime after November of this year, due to "disturbance by opposition parties." However, the delay in the second hearing will not be allowed to affect the planned construction schedule. The two 1,100 MWe units are scheduled for commercial operations in 1989.

In September, the EPRDCC formally approved the construction of Kyushu Electric Power Company's Genkai Units 3 and 4, two 1,180 MWe PWRs. Construction is scheduled to begin in 1984, for commercial operations in 1990 and 1991.

Unfortunately, Japan is not immune from declining electrical load growth forecasts. TEPCO is now considering whether to delay by 6-12 months the commercial operating dates for Kashiwazaki Unit 1 (now scheduled for 1985) and Fukushima Units 3 and 4 (1985 and 1986).

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One more piece of good news, however. The plant availability of all operating nuclear units in Japan — 24 units accounting for 17,177 gross MWe — for the first half (April 1 to September 30) of the current fiscal year has established a record of 73.6 percent. Given the required shutdowns for maintenance and inspections, a 75 percent availability is the maximum achievable. The record result looks especially good when compared against last year's 66 percent figure. Also, if Japan achieves the expected capacity factor for the second half of the fiscal year, this will be the third consecutive year above 60 percent. That trend compares favorably with 1981 results in the US (56.4 percent), France (57.8 percent) and West Germany (67.7 percent).

## UNITED STATES

The only operating High Temperature Gas-cooled Reactor (HTGR) in the US received its full power operating license this month. Public Service Company of Colorado had been limited to operating the unit at 70 percent power for some time.

Kansas Gas and Electric announced that its Wolf Creek unit will be delayed by approximately one year. The utility's projected operating date is now the spring of 1985.

* * *

With the persistent decline in uranium prices, the closing of US production facilities and the withdrawal from the business of numerous US producers, there has been a sharp increase in the number of uranium properties being offered for sale. However, buyers are few in number and tend to be very selective in view of the wide range of opportunities available. Recent transactions are characterized by little or no cash, with future payments tied to future production, if any.

* * *

An event having the potential to affect the uranium market was the establishment this month of a mechanism enabling individuals to trade in uranium concentrates. The American Uranium Company, a subsidiary of Edlow International, is now offering certificates representing one hundred pounds of uranium concentrates which can be purchased and traded in a retail, cash, spot market in much the same manner as in a conventional commodity market.

Although it is too early to determine whether investors and speculators will be attracted and participate in sufficient numbers to develop a viable market, the subject has aroused much interest within the uranium community. It appears that the ultimate success of this venture will depend on developing a market of sufficient size and sophistication that producers and users will find it useful in their marketing and procurement activities, or in hedging their risks. If, for example, a producer could utilize the mechanism to insure a minimum level of profitability, or if the utility could use it to assure a ceiling on cost, then the system would likely have commercial application.

* * *

The much debated US uranium import embargo legislation is presently stalled pending the return of Congress in November. In the interim, the full spectrum of responses to the subject are being discussed. It appears that, as time passes, the predominant attitude toward the prospect of the enactment of the proposed embargo is becoming one of resignation. This development, of course, will probably have little or no effect on the outcome of the vote in Congress.

## ENRICHED URANIUM AND SWU

DOE has begun the process of reviewing the comments received on the draft Facility Requirements (FR) contract and the responses to the questionnaires sent to all DOE customers during August. DOE is expected to complete their review after the new year, and then issue the final FR contract and, more importantly, the terms and conditions of converting existing DOE contracts to the new form.

Major criticisms of the new contract as proposed include:

1. The high termination charges that do not decrease with time;
2. The long lead time of 30 months required for assignments or substitutions of other DOE enriched material.

In addition, some DOE customers are dissatisfied with the FR contract concept completely and are requesting that DOE simply return to offering the requirements contract form.

DOE's actions with regard to the conversion of existing contracts are being watched very closely due to the dramatic effect a large scale conversion of AFC contracts to the FR form would have on the secondary

## *MARKET ACTIVITIES*

SWU market. Nuexco's analysis of these effects will be published next month in Report 172.

In the meantime, the secondary SWU market remains quite active. There are a number of buyers still seeking secondary market supply for the DOE fiscal year ending September 30, 1983 (FY83), mainly requirements contract holders who have either already terminated deliveries or expressed willingness to do so if the discounts offered are attractive. In addition, there are some small buyers who are seeking excess SWUs above their requirements contract Appendix A commitments ceiling.

A number of high-discount sellers of FY83 DOE SWUs have recently sold out, so present discounts from the Adjustable Fixed Commitment (AFC) contract price available on the secondary market for FY83 have decreased somewhat. When calculated at 0.20 percent tails assay, the discount is approximately $25 per SWU. This discount is not sufficient to allow any requirements contracts holders who have not yet terminated for FY83 to do so economically.

Discounts available from the AFC price for FY84 remain in the range of approximately $27-$30 (when calculated at .2 tails), due mainly to the number of sellers who have elected (under the VTAO) the more attractive .3 tails for FY84 for selling purposes. However, many potential buyers are reluctant to commit now. Some prefer to wait until their actual requirements are better known; others hope to obtain an even larger discount next year from sellers desperate for cash.

Discounts available for FY85 are significantly less than they have been in recent months, due primarily to two factors.

1. One high-discount FY85 seller has sold out and withdrawn from the market.

2. Other sellers are reluctant to commit to a high discount before DOE announces the terms and conditions of conversion to the new FR contract. DOE has previously given an indication that excess commitments past FY86 may be allowed to be slipped upon conversion to the FR contract. Therefore, potential sellers for FY85 may be better off to simply buy and hold their excess FY85 commitments and slip future commitments until needed.

There are virtually no DOE SWU sellers for 1986 and future years. Again, potential sellers are awaiting DOE's terms and conditions for converting to the FR contract.

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## URANIUM SUPPLY
### (As of 10/31/82)

| Nuexco Reference Number | Delivery Period[1] (Thousands of Pounds $U_3O_8$) 0 to 1 Year | Beyond 1 Year | Remarks |
|---|---|---|---|
| **Available for Sale:** | | | |
| **ACTIVE** | | | |
| 1575 | | 500 per year | Long Term |
| 1951 | 1,250 | | |
| 1986 | 40 | | |
| 2017 | | 2,350 | 1984-86 |
| 2020 | | 200 per year | 1983-92 |
| 2027 | 1,000 | | |
| 2038 | 1,500 | | UF6 |
| 2045 | 500 | | |
| TOTAL: | 4,290 | | |
| **INACTIVE** | | | |
| 1581B | | 100 per year | Long Term |
| 1804 | 615 | | |
| 1805 | | 500 per year | Long Term |
| 1818 | | 250 per year | Long Term |
| 1877 | 100 | | |
| 1925 | 500 | | $UF_6$ |
| 1928 | 1,000 | | $UF_6$ |
| TOTAL: | 2,215 | | |

[1] Measured from the date of this Report

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*MARKET DATA*

## URANIUM DEMAND
(As of 10/31/82)

| Nuexco Reference Number | Delivery Period[1] (Thousands of Pounds $U_3O_8$) | | Remarks |
|---|---|---|---|
| | 0 to 1 Year | Beyond 1 Year | |
| **Inquiries to Purchase:** | | | |
| **ACTIVE** | | | |
| 1638 | | 250 per year | 1983-89 |
| 1871 | | 250 per year | 1983-86 |
| 1915 | | 500 | $UF_6$ |
| 1995 | 250 | | |
| 1996 | | 600 | |
| 2000 | 350 | 250 | |
| 2005 | | 1,000 | |
| 2010 | | 400 per year | 1984-92 |
| 2014 | 160 | | |
| 2023 | | 200 | |
| 2030 | | 1,350 | 1984-85 |
| 2031 | 1,000 | | $UF_6$ |
| 2032 | | 200 | |
| 2033 | 300 | | $UF_6$ |
| TOTAL: | 2,060 | | |
| **INACTIVE** | | | |
| 1459 | | 200 per year | Long Term |
| 1652 | | 200 per year | Long Term |
| 1843 | 250 | | |
| 1888 | | 500 per year | Long Term |
| 1923 | 30 | | |
| 1935 | | 400 | |
| 1963 | | 180 | |
| 1966 | 100 | 200 | |
| 1978 | 200 | 200 | |
| 1979 | 30 | 175 per year | 1983-87 |
| 1999 | | 50 per year | 1985-90 |
| 2004 | 100 | | |
| 2025 | | 330 | |
| TOTAL: | 710 | | |

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[1] Measured from the date of this Report.

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## CONVERSION SUPPLY
(As of 10/31/82)

| Nuexco Reference Number | Delivery Period[1] (Thousands of Pounds U as $UF_6$) | | Remarks |
|---|---|---|---|
| | 0 to 1 Year | Beyond 1 Year | |
| **ACTIVE** | | | |
| 1607 | 200 | | |
| 1609 | 500 | 1,500 per year | Long Term |
| 1936 | 1,000 | 200 per year | Long Term |
| TOTAL: | 1,700 | | |
| **INACTIVE** | | | |
| 1619 | 250 | 250 | |
| 1902 | | 350 | |
| 1925 | 450 | | |
| 2008 | 800 | 800 | |
| TOTAL | 1,500 | | |

## CONVERSION DEMAND
(As of 10/31/82)

| Nuexco Reference Number | Delivery Period[1] (Thousands of Pounds U as $UF_6$) | | Remarks |
|---|---|---|---|
| | 0 to 1 Year | Beyond 1 Year | |
| **ACTIVE** | | | |
| 1995 | 220 | | |
| 2018 | 100 | | |
| TOTAL: | 320 | | |
| **INACTIVE** | | | |
| 1594 | 400 | 450 per year | Long Term |
| 1622 | 250 | 700 | |
| TOTAL: | 650 | | |

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[1] Measured from the date of this Report.

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*MARKET DATA*

## LOAN SUPPLY AND DEMAND
(As of 10/31/82)

| Nuexco Reference Number | Delivery Period[1] (Thousands of Pounds $U_3O_8$) 0 to 1 Year | Beyond 1 Year | Remarks |
|---|---|---|---|
| **Available for Loan:** | | | |
| **ACTIVE** | | | |
| 1815 | 1,000 | | |
| 1919 | 1,000 | | |
| 1938 | 2,000 | | |
| 2006A | 600 | | |
| 2036 | 200 | | |
| TOTAL: | 4,800 | | |
| **INACTIVE** | | | |
| 1884 | 600 | | |
| 1910 | 1,000 | | |
| 1931 | 600 | | |
| 2040 | 500 | | $UF_6$ |
| TOTAL: | 2,700 | | |
| **Inquiries to Borrow:** | | | |
| **ACTIVE** | | | |
| 1998 | 200 | 200 | |
| 2006 | 600 | | |
| TOTAL: | 800 | | |
| **INACTIVE** | None | | |

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[1] Measured from the date of this Report

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## CURRENT TRANSACTIONS[1]

### Uranium Transactions

| Nuexco Reference Number | Delivery Period | Approximate Quantity (thousands of pounds, $U_3O_8$ equivalent) | Approximate Price as Percent of Current E.V. | Seller | Buyer | Remarks |
|---|---|---|---|---|---|---|
| 1978 | 1984-91 | 601-1000 | Indeterminate | Canadian Producer | US Utility | Price related to market |
| 1982 | 1982 or 83 | 101-300 | 97 (est.) | US Utility | European Utility | $UF_6$ |
| 1987 | 1982 | Less than 50 | 95 | US Producer | Broker | |
| 1992 | 1982 | Less than 50 | 100 | US Producer | US Producer | |
| 1993 | 1982-83 | 101-300 | 97 | US Producer | Broker | |
| 1994 | 1982 | 101-300 | 99 | US Producer | US Producer | |
| 2004 | 1982 | 50-100 | 98 | US Producer | US Producer | |
| 2005 | 1982 | 101-300 | 101 | US Producer | Broker | |
| 2011 | 1983 | 301-600 | 100 (est.) | Broker | European Utility | $UF_6$ |

### Conversion Transactions

| Nuexco Reference Number | Delivery Period | Approximate Quantity (thousands of pounds, U equivalent) | Approximate Price as Percent of Current C.V. | Seller | Buyer | Remarks |
|---|---|---|---|---|---|---|

There are no conversion transactions reported this month.

### Loan Transactions

| Nuexco Reference Number | Delivery Period | Approximate Quantity (thousands of pounds, $U_3O_8$ equivalent) | Approximate Price as Percent of Current L.U.C.R. | Lender | Borrower | Remarks |
|---|---|---|---|---|---|---|
| 1979 | 1982 | 301-600 | 100 | US Utility | US Producer | |

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[1] Transactions listed are not limited to those in which Nuexco was involved, but also include others of which Nuexco is aware.

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*MARKET ANALYSIS*

## THE VARIABLE TAILS ASSAY OPTION: ITS SIGNIFICANCE TO THE SECONDARY SWU MARKET

Nuexco's brokerage experience indicates that the availability of the VTAO has encouraged the existence of an active secondary market in SWU. The VTAO has had the following commercial effects:

1. It has effectively reduced the economic penalty of selling SWU. Without the VTAO, some utilities having excess SWU commitments would decide simply to hold enriched uranium inventory. Having the option to vary their tails assay, those same utilities now find it economic to sell at the somewhat lower discounts necessary to complete a transaction at a higher tails assay.

2. It has enabled more utilities holding DOE requirements contracts to obtain the effective discounts necessary to economically terminate and buy replacement DOE SWU on the secondary market.

An example will illustrate the use of the VTAO to facilitate a secondary market SWU transaction:

1. Utility A, wishing to dispose of excess SWU commitments, has elected a tails assay for its fiscal year 1983 (FY83) deliveries of 0.28 w/o (weight percent) under the VTAO.

2. Utility B, holding a 3.5 year termination requirements contract, decides to partially terminate its minimum expected requirements for FY83 of 100,000 SWU and buy the replacement SWUs from Utility A. Utility B pays DOE a termination charge of $37.46 for each SWU terminated (25 percent of the requirements contract price, $149.85 per SWU).

3. Utility B, just to break even, must therefore receive an effective SWU price of $112.39 per SWU ($149.85-$37.46).

4. In order to have some incentive to complete the transaction, Utility B decides it needs an additional discount of $3 per SWU, or a price of $109.39.

5. Therefore, if Utility A were selling SWU at a tails assay of 0.20 w/o, Utility A would need to offer a discount of $29.26 off the Adjustable Fixed Commitment (AFC) price per SWU ($138.65-$109.39).

Since Utility A is offering 0.28 w/o tails rather than .2 tails, however, the discount offered will be significantly less than $29.26, depending on the enriched product assay Utility B wants, as well as the marginal cost of $UF_6$ feed. *Note that Utility B's historical cost of feed does not affect the calculation, only the marginal cost of buying additional feed (in place of SWU) on the open market.*

Assuming that Utility B wants an enriched product assay of 3.4 percent, and that the marginal cost of feed in the spot market is $48 per KgU, the discount offered by Utility A could be calculated as follows:

1. Calculate the amount of enriched product Utility B wants, as well as the quantity of SWUs and natural feed required at .2 tails.

100,000 SWU at .2 tails will produce 100,000/5.19 or 19,268 KgU as 3.4 percent enriched $UF_6$, and requires 19,268 × 6.26 or 120,618 KgU as natural $UF_6$ feed.

2. Calculate the quantity of SWUs and feed that would be required at .28 percent tails assay.

19,268 KgU at 3.4 percent enrichment with .28 tails requires 19,268 × 4.32 or 83,238 SWU and 19,268 × 7.24 = 139,500 KgU feed.

3. Calculate the cost of 19,268 KgU at 3.4 percent enrichment with .2 w/o TA.

100,000 SWU × $109.39 per SWU ($138.65-$29.26) + 120,618 KgU feed × feed price ($48 per KgU feed) = $16,728,664.00.

4. In order to calculate the SWU price (SP) at .28 TA that would be equivalent to a discount of $29.26 at .2 TA, set the cost of product at .2 TA equal to the cost of the *same amount* of product (19,268 KgU as $UF_6$) at .28 TA.

5. Thus, at .28 TA, the cost of 19,268 KgU as 3.4 percent enriched $UF_6$ would be calculated as

83,237 SWU × SP in $ per SWU + 139,500 KgU feed × feed price ($48 per KgU feed) = $16,728,664.00.

6. Thus, 83,238 × SP = $10,032,664, so SP = $120.53.

Solving for SP indicates that a price of $120.53 per SWU at .28 tails offered by Utility A will be effectively equivalent to a SWU price of $109.39 at .2 tails. So Utility A only would need to offer a discount of $138.65 – $120.53, or $18.12 per SWU to complete this transaction.

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## URANIUM OCCURRENCES IN FINLAND

### Introduction

The Finnish government initiated uranium exploration in the early 1950s. A modest effort, its purpose was to determine the country's potential uranium resources. A number of isolated occurrences were discovered within the first few years, and the government concluded that geological conditions throughout the country presented favorable potential for sufficient uranium resources to support a domestic nuclear power program. The exploration effort has continued through the years with limited success. Reasonably Assured Resources (RAR) in Finland presently are estimated at about 3200 tonnes $U_3O_8$ recoverable at US$50. Uranium is not now being produced in Finland.

The government made a policy decision to develop a nuclear power base for Finland in the late 1960s. The first nuclear power plant went into service in 1977. Finland now has four plants operating at a total capacity of 2160 Mw, accounting for almost 20 percent of the country's total electricity generation. A fifth nuclear plant, presently under consideration, could add another 1000 Mw to the power system by about 1991.

Finnish uranium requirements are presently about 860,000 pounds $U_3O_8$ per year, all supplied by foreign sources. The government is committed to establishing a domestic uranium industry to offset dependence on foreign uranium. The continuing uranium resource evaluation program may have to be accelerated if this commitment is to be accomplished.

### Exploration History

The government has always controlled the evaluation of mineral resources in Finland. The mining law dictates that foreign groups are required to seek special permission from the Council of State to participate in the evaluation and exploitation process for any mineral resource. The Council has not granted such permission during the last 30 to 40 years. All activity has been delegated to the domestic mining industry.

The claiming of potential mineral lands and subsequent evaluation activity is under the jurisdiction of the Industry Department of the Ministry of Commerce & Industry. The Energy Department of the Ministry is assigned all energy-related projects including the availability of nuclear fuel from domestic sources.

The national uranium evaluation and exploitation program is in turn controlled by the Atomic Energy Commission which consists of varied internal agencies, led by the Uranium Exploration Advisory Board. Members of the Advisory Board are active representatives from the Ministry of Commerce & Industry, the Geological Survey, mining companies, and electric power companies.

The Atomic Energy Commission assigned the Geological Survey of Finland (GSF) the primary responsibility for uranium exploration. A staff of about 20 geologists, technicians and assistants carry out the assigned tasks with an annual budget of approximately US$375,000. All exploration programs begin with a preliminary geological investigation and mapping of a prospect area to establish rock type, structure and related geological characteristics favorable to uranium mineralization.

Glacial drift hinders exploration, especially in northern Finland. However, the problem is at least partially overcome by utilizing ground and airborne geophysical techniques to detect buried geological features which may be of interest. The GSF continues prospect evaluation with detailed geophysical and geochemical procedures plus trenching and drilling to obtain sufficient rock samples for assaying. Once a promising discovery has been made, the GSF may appoint a state-owned or private mining company to complete property evaluation and development. Commercial development of a property is carried out under the close jurisdiction of the Ministry of Commerce & Industry.

The GSF and national mining companies offer cash incentives to the general public for submitting information and rock samples that may lead to new prospects. The program has been extremely successful in the past as amateur prospectors annually submit 20,000 to 25,000 mineral samples for evaluation. If a sample contains interesting mineralization, the agencies follow up with a property examination. The cash reward is granted after prospect potential has been determined; the amount varies considerably depending on the value of the discovery. A sample with interesting mineralization will pay US$100 to 500; a sample which leads to detailed property evaluation and core drilling will be rewarded by US$500 to 4,000; if a commercial ore deposit is discovered, payment can increase to US$25,000, the highest amount yet paid to a prospector.

Success of the incentive program is verified by the fact that more than 60 percent of known ore deposits in Finland were discovered by amateur prospectors. The discovery ratio for uranium mineralization is less than 60 percent; nevertheless, the program has been impor-

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*RAW MATERIALS*

tant to the ongoing evaluation of Finland's uranium resources. The limited staff of the GSF is somewhat dependent on the amateur prospector to carry out the reconnaissance-type prospecting in the more remote areas of Finland.

**General Geology**

The geology of Finland consists almost entirely of Precambrian crystalline rocks of the Fennoskandian Shield complex. As in Sweden and Norway, the shield rocks of Finland consist of highly metamorphosed sediments, granites and volcanics which vary in age from 2800 to 1300 million years (m.y.). Probably the oldest rocks in Finland are the graphitic metasediments, quartz-banded iron formations and the carbonatite complex found in east-central Finland. The rocks are considered Archean in age and have been dated at plus 2800 m.y. old. Recrystallization of Archean rocks occurred during the Svecokarelian Orogeny, age dated at about 2000 to 1800 m.y.

The oldest rocks of Proterozoic Age are the quartzitic schiests of the Lower Jatulian Formation (2600 m.y.). The Lower Jatulian is in uncomformable contact with Archean rocks. Basal Jatulian deposition consisted of arkosic sandstones and conglomerates. The basal units were metamorphosed to quartzites and quartz conglomerates. Uranium mineralization occurs in association with the quartzitic zones near the contact with Archean basement rocks. The contact zone just described is probably the most favorable environment for the occurrence of uranium mineralization in Finland.

During the Svecokarelian Orogeny, the older rocks were intensely folded, metamorphosed and altered by numerous intrusions of quartz diorites and granites. A long period of erosion and alteration took place after the orogeny. Sediments and volcanic flows of Cambrian-Silurian age were deposited on the eroded surface. Younger formations were in turn deposited to build up a geologic sequence through the Cenezoic period. Each in turn was eroded away to leave the Proterozoic/Archean surface as it now occurs throughout Finland. The entire Fennoskandian Shield area has remained fairly stable since the end of the Svecokarelian Orogeny, and is masked only by glacial till which was deposited during the ice age.

**Uranium Occurrences**

The Reasonably Assured Resources (RAR) of Finland are found in at least five different geologic environments; additional uranium is found in five other rock-types. There are over 30 known occurrences widely scattered throughout the country. The most prolific environment is Precambrian rocks associated with the unconformity. Several of the important occurrences shown on Figure 1 are discussed below.

Perhaps the most notable uranium occurrences to be found in Finland was the Paukkajanvaara deposit located in the Eno district. The deposit was discovered by prospectors in the mid-1950s. The main mineralized zone was found by trenching and drilling in Lower Jatulian conglomerates and quartzites immediately above the unconformable contact with Archean rocks. Uranophane and pitchblende mineralization occurred as fracture and vein filling in a highly altered segment of the Precambrian rocks.

The government appointed a private mining company, Atomienergia Oy, to mine the ore and to establish a metallurgical process to recover the uranium. The company mined 31,000 tonnes ore by underground and open pit methods between 1958 and 1961. The ore averaged 0.14 percent $U_3O_8$ and about 80,000 pounds of uranium were recovered. The highest grade portion of the deposit was essentially mined out; no uranium mining and milling has taken place in Finland since 1961.

Exploration was stimulated by the discovery at Paukkajanvaara. Within a short time, mineralization had been discovered in four nearby prospects. The uranium always occurs in sheared, fractured and highly altered metasediments of Lower Jatulian rocks as at Riutta, or in Archean rocks as at Revonkyla. Each occurrence is closely associated with the unconformity, and generally has low uranium values.

There are two small deposits in the district that contain ore reserves—the Herajarvenkannas and Ipatti deposits in the Lieksa area. Pitchblende is found in Lower Jatulian quartzites and quartz-conglomerates in both deposits. The former contains about 20,000 tonnes ore at an average uranium content of 0.10% $U_3O_8$. (About 500 tonnes ore were mined from the deposit in 1960 and 1961 for metallurgical tests.) The latter contains reserves estimated at 70,000 tonnes averaging 0.09 percent $U_3O_8$. The deposits represent a combined RAR of about 80 tonnes $U_3O_8$.

Outokumpu Oy has discovered uranium mineralization at three locations on the Kittila greenstone belt in northwestern Finland. The most important is the Pahtavuoma deposit. Uranium is found in a host of fractured meca schists and phyllites which are part of the greenstone complex of Archean age. Uranium reserves

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have been estimated at 300,000 tonnes ore averaging 0.22 percent $U_3O_8$, representing about 600 tonnes $U_3O_8$. The main ore mineral is uraninite, occurring in association with copper and molybdenite minerals.

The source of mineralization is considered to be related to volcanism that occurred during late stage development of the greenstone complex. The uranium was present in Archean rocks, but not necessarily restricted to greenstones. It was at least partially recrystallized and remobilized through prolonged contact with migrating hydrothermal solutions during late Archean tectonics and the period of extensive metamorphism and alteration associated with the development of the unconformity at about 2600 m.y., and again during the Svecokarelian Orogeny at about 2000 to 1800 m.y. Uranium and any associated minerals precipitated as the solutions made contact with favorable host conditions. Most of the uranium deposits in Finland probably originated in this manner.

Two of the largest uranium occurrences known in the country are the Lampinsaari and Nuottijarvi deposits in central Finland. In both deposits, uranium occurs as a minor co-mineral with phosphate rock. The Lampinsaari deposit is in apatite-bearing carbonate rocks and apatite-quartz gneisses of the Jatulian Formation. The uranium content is low, averaging 0.04 percent $U_3O_8$. Ore reserves have been estimated at 2,500,000 tonnes; thus, the deposit contains about 1000 tonnes $U_3O_8$ which could be recovered as a by-product to phosphate.

The Nuottijarvi phosphate deposit occurs in a breccia zone within a Jatulian quartzite. The uranium occurs with apatite in association with quartz and feldspar. Ore reserves, including uranium, are the same as at Lampinsaari. The potential to recover the uranium is the same also.

Large, low grade (0.01 to 0.03 percent $U_3O_8$) uranium occurrences are known in Lower Jatulian black schists, Middle Jatulian siltstones and Archean carbonatites. The occurrences are scattered throughout the country and represent tens of millions of tonnes of rock containing large uranium resources. However, uranium recovery from these deposits depends upon favorable industry economics and a metallurgical breakthrough; otherwise, the occurrences are classified as Speculative Resources.

The uranium exploration program of Finland has been successful in proving favorability of the geology for uranium occurrences. It is recognized by the GSF that considerable potential exists for the discovery of economically important deposits in Finland.

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*RAW MATERIALS*

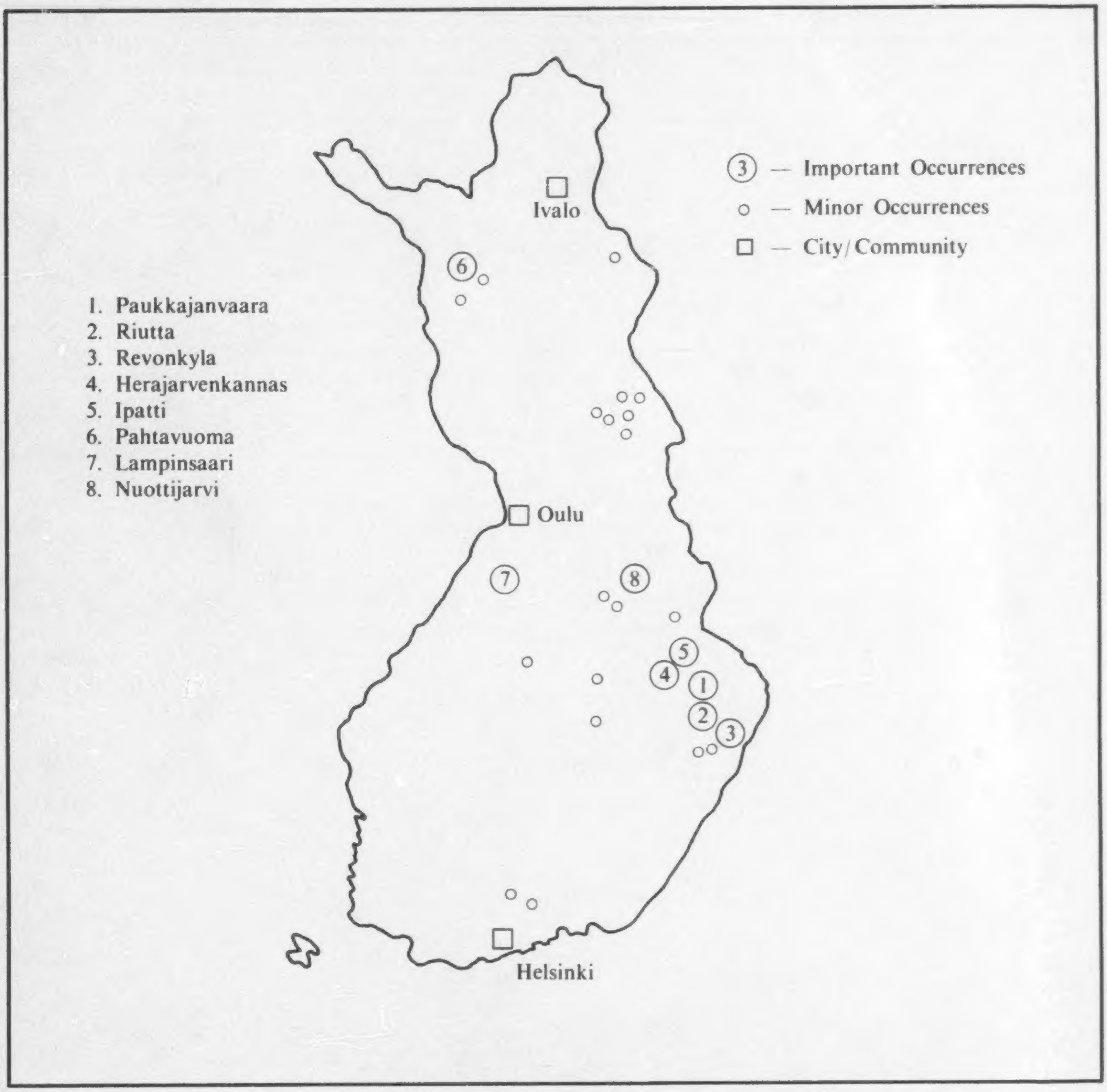
1. Paukkajanvaara
2. Riutta
3. Revonkyla
4. Herajarvenkannas
5. Ipatti
6. Pahtavuoma
7. Lampinsaari
8. Nuottijarvi
③ — Important Occurrences
○ — Minor Occurrences
☐ — City/Community
Ivalo
⑥
Oulu
⑦
⑧
⑤
④
①
②
③
Helsinki

**Figure 1**

**URANIUM OCCURRENCES OF FINLAND**
**Numbered occurrences are described in text**

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*STATISTICAL DATA*

**EXCHANGE VALUE $17.50/lb. $U_3O_8$**
Determined as of October 31, 1982

**Definition**[1]

The Exchange Value is Nuexco's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the last day of the month.

**Derivation**

Nuexco bases the Exchange Value upon:

A. Data from recently completed transactions.
B. Data from pending transactions.
C. Firm bids to buy and firm offers to sell.
D. Prices purchasers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy, and prices sellers have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell.

**Comments**

Nuexco does not consider the following in determining the Exchange Value:

A. The price of uranium delivered or to be delivered under old contracts.
B. The price of uranium delivered in connection with contract renegotiations or other than arm's length transactions.

[1] In December, 1981, Nuexco published a history of the Exchange Value which chronicled, month-by-month, changes in its definition, usage and derivation. Copies are available upon request.

**TRANSACTION VALUE**[2]
Determined as of October 31, 1982

| $/lb. $U_3O_8$ | Millions of Pounds | Number of Transactions | Number of Months |
|---|---|---|---|
| 17.00 | 3.6 | 20 | 3 |

**Definition**

The Transaction Value is a weighted average price of recent transactions, and is based on prices paid for $U_3O_8$ in transactions closed within the previous three-month period and for which delivery was scheduled within one year of the transaction date. At least ten transactions totaling at least two million pounds $U_3O_8$ are included in each calculation, or the sample time is extended as necessary to include these minima. Foreign currencies are converted to US dollars as of the transaction date.

[2] Transaction Values for 1976 through 1981 and their associated parameters (millions of pounds, number of transactions and number of months) are tabulated on pages 31 and 32 of Report 161.

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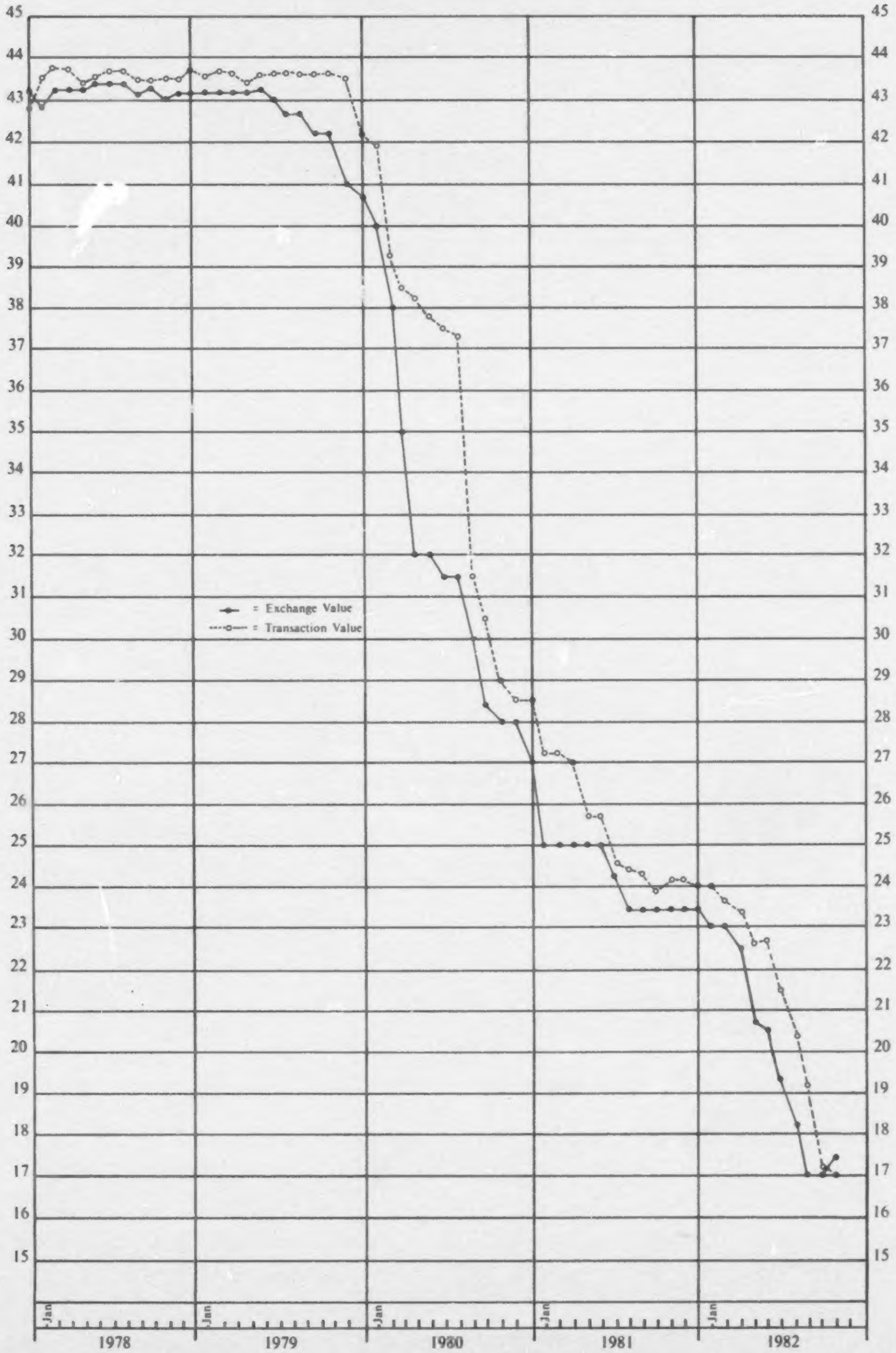
*STATISTICAL DATA*

## EXCHANGE AND TRANSACTION VALUES SINCE JANUARY 1978

Determined as of the last day of the month indicated



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## HISTORICAL EXCHANGE VALUES

Determined as of the last day of the month indicated (US Dollars/lb. $U_3O_8$)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1968 | — | — | — | — | — | — | — | 6.35 | 6.35 | 6.40 | 6.45 | 6.50 |
| 1969 | — | 6.35 | 6.10 | 6.10 | 6.25 | 6.25 | 6.20 | 6.20 | 6.15 | 6.15 | 6.15 | 6.20 |
| 1970 | 6.30 | 6.30 | 6.30 | 6.30 | 6.30 | 6.30 | 6.30 | 6.20 | 6.15 | 6.15 | 6.15 | 6.15 |
| 1971 | 6.20 | 6.20 | 6.20 | 6.20 | 6.15 | 6.05 | 6.00 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 |
| 1972 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 |
| 1973 | 5.95 | 6.00 | 6.10 | 6.20 | 6.45 | 6.50 | 6.50 | 6.50 | 6.50 | 6.50 | 6.75 | 7.00 |
| 1974 | 7.70 | 7.90 | 8.00 | 9.00 | 9.50 | 10.50 | 11.50 | 12.00 | 12.50 | 14.00 | 14.75 | 15.00 |
| 1975 | 16.00 | 16.00 | 18.00 | 20.00 | 21.00 | 23.00 | 24.70 | 26.00 | 26.00 | 28.50 | 30.00 | 35.00 |
| 1976 | 35.20 | 37.00 | 39.25 | 40.00 | 40.00 | 40.00 | 40.00 | 40.40 | 41.00 | 41.00 | 41.50 | 41.00 |
| 1977 | 41.35 | 41.50 | 41.60 | 41.60 | 42.00 | 42.25 | 42.25 | 42.25 | 42.40 | 42.75 | 43.20 | 43.20 |
| 1978 | 42.90 | 43.25 | 43.25 | 43.25 | 43.40 | 43.40 | 43.40 | 43.10 | 43.25 | 43.00 | 43.25 | 43.25 |
| 1979 | 43.25 | 43.25 | 43.25 | 43.25 | 43.25 | 43.00 | 42.70 | 42.70 | 42.20 | 42.20 | 41.00 | 40.75 |
| 1980 | 40.00 | 38.00 | 35.00 | 32.00 | 32.00 | 31.50 | 31.50 | 30.00 | 28.50 | 28.00 | 28.00 | 27.00 |
| 1981 | 25.00 | 25.00 | 25.00 | 25.00 | 25.00 | 24.25 | 23.50 | 23.50 | 23.50 | 23.50 | 23.50 | 23.50 |
| 1982 | 23.00 | 23.00 | 22.50 | 20.75 | 20.50 | 19.25 | 18.25 | 17.00 | 17.00 | **17.50** | | |

## HISTORICAL TRANSACTION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. $U_3O_8$)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1976 | — | — | — | — | 39.60 | 39.70 | 39.70 | 40.40 | 40.30 | 40.60 | 40.70 | 40.70 |
| 1977 | 41.30 | 41.30 | 41.40 | 41.50 | 42.80 | 42.90 | 43.00 | 42.60 | 42.50 | 42.80 | 42.90 | 42.90 |
| 1978 | 43.10 | 43.30 | 43.70 | 43.60 | 43.60 | 43.20 | 43.30 | 43.40 | 43.40 | 43.60 | 43.40 | 43.70 |
| 1979 | 43.60 | 43.80 | 43.70 | 43.40 | 43.60 | 43.70 | 43.70 | 43.60 | 43.60 | 43.60 | 43.50 | 42.30 |
| 1980 | 42.00 | 39.30 | 38.60 | 38.40 | 37.90 | 37.60 | 37.30 | 31.60 | 30.60 | 29.00 | 28.70 | 27.70 |
| 1981 | 27.20 | 27.20 | 27.00 | 25.70 | 25.70 | 24.50 | 24.40 | 24.30 | 23.90 | 24.10 | 24.10 | 24.00 |
| 1982 | 24.00 | 23.70 | 23.40 | 22.60 | 22.70 | 21.50 | 20.30 | 19.10 | 17.30 | **17.00** | | |

## EXCHANGE VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

| Country | per lb. $U_3O_8$ in Concentrates | per kg $U_3O_8$ in Concentrates | per kg U in Concentrates |
|---|---|---|---|
| US (dollar) | 17.50 | 38.58 | 45.50 |
| France (franc) | 126.26 | 278.36 | 328.25 |
| FRG (mark) | 44.64 | 98.42 | 116.06 |
| Japan (yen) | 4,834 | 10,658 | 12,568 |
| Switzerland (franc) | 38.55 | 85.00 | 100.23 |
| UK (pound) | 10.40 | 22.92 | 27.03 |
| Australia (dollar) | 18.70 | 41.23 | 48.62 |
| Canada (dollar) | 21.45 | 47.30 | 55.78 |
| Niger, Gabon (CFA) | 6,318 | 13,928 | 16,425 |
| South Africa (rand) | 20.42 | 45.01 | 53.08 |
| Sweden (kroner) | 130.01 | 286.63 | 338.01 |

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[1] Calculated using currency exchange rates published in the Wall Street Journal on the last business day of the month.

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*STATISTICAL DATA*

**CONVERSION VALUE $1.60/lb. U as $UF_6$**
Determined as of October 31, 1982

**Definition**

The Conversion Value is Nuexco's judgment of the price at which spot and/or near term transactions for significant quantities of conversion services could be concluded in the secondary market as of the last day of the month.

**Derivation**

Nuexco bases the Conversion Value upon:
A. Data from recently completed transactions.
B. Data from pending transactions.
C. Firm bids to buy and firm offers to sell.
D. Prices purchasers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy, and prices sellers have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell.

**Comments**

Nuexco does not consider the following in determining the Conversion Value:
A. The price of conversion services delivered or to be delivered under old contracts.
B. The price of conversion services delivered in connection with contract renegotiations or other than arm's length transactions.

**LOAN USE CHARGE RATE[1] 6%**
Determined as of October 31, 1982

**Definition**

The Loan Use Charge Rate is Nuexco's judgment of the annual interest rate at which uranium loans could be concluded as of the last day of the month.

**Derivation**

Nuexco bases the Loan Use Charge Rate upon:
A. Data from recently completed or pending loan transactions.
B. Rates included in firm proposals to borrow or lend.
C. Rates that potential borrowers and lenders have expressed as a willingness to pay or accept, but for which Nuexco is not aware of firm proposals.

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[1] Monthly data for 1968 through 1981 appear on pages 32-34 of Report 162.

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## AUSTRALIAN GOVERNMENT STATISTICS

| | Price Index of Materials Used in Manufacturing Industry—All Groups (Year 1968-69 = 100.0)[1] | Weighted Average Minimum Weekly Wage Rates—Adult Males Australia Mining and Quarrying (A$)[2] |
|---|---|---|
| Annual Avg. 1971[3] | 101.5 | 65.95 |
| Annual Avg. 1972[3] | 105.6 | 71.26 |
| Annual Avg. 1973[3] | 124.4 | 78.96 |
| Annual Avg. 1974[3] | 141.9 | 108.07 |
| Annual Avg. 1975[3] | 150.4 | 132.55 |
| Annual Avg. 1976[3] | 168.4 | 160.93 |
| Annual Avg. 1977[3] | 192.0 | 179.03 |
| Annual Avg. 1978[3] | 198.5 | 190.04 |
| Annual Avg. 1979 | 248.8 | 196.34 |
| Annual Avg. 1980 | 321.8 | 218.00 |
| Annual Avg. 1981 | 355.3 | 237.34 |
| May 1981 | 353.4 | 237.31 |
| Jun 1981 | 360.4 | 237.93 |
| Jul 1981 | 356.9 | 237.86 |
| Aug 1981 | 359.9 | 237.86 |
| Sep 1981 | 357.4 | 238.00 |
| Oct 1981 | 351.6 | 239.26 |
| Nov 1981 | 351.3 | 241.31 |
| Dec 1981 | 349.9 | 258.56 |
| Jan 1982 | 354.9 | 261.58 |
| Feb 1982 | 356.7 | 262.95 |
| Mar 1982 | 360.3 | 263.12 |
| Apr 1982 | 367.7R | 262.99 |
| May 1982 | 367.6R | 263.24 |
| Jun 1982 | 367.2R | 264.19 |
| Jul 1982 | 369.1P | 268.20 |
| Aug 1982 | 371.5P | |

P = Preliminary R = Revised since last month

[1] Australian Bureau of Statistics, Canberra: "Price Index of Materials Used in Manufacturing Industry" (Catalogue No. 6411.0), Table 3.

[2] Australian Bureau of Statistics, Canberra: "Wage Rates, Australia" (Catalogue No. 6312.0), Table 1. Figures for the latest fourteen months shown are subject to revision.

[3] Monthly data for 1970 through 1978 appear on pages 4.7 and 4.8 of Nuexco Report 138.

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*STATISTICAL DATA*

## CANADIAN GOVERNMENT STATISTICS

| | Industry Selling Price Index: Manufacturing (D 500000)[1] [2] (1971 = 100.0) | Wage-earner Data: Average Hourly Earnings (C$)[3] [4] | | |
|---|---|---|---|---|
| | | Metal Mining, including Milling (SIC 050-059) | Primary Metal Industries, non-ferrous (SIC 296-298) | Chemicals and Chemical Products (SIC 370-379) |
| Annual Avg. 1978 | 190.4 | 8.76 | 6.82 | 6.97 |
| Annual Avg. 1979 | 217.9 | 9.60 | 7.35 | 7.67 |
| Annual Avg. 1980 | 247.2 | 10.59 | 8.05 | 8.50 |
| Annual Avg. 1981 | 272.3P | 12.02 | 9.03 | 9.53 |
| Aug 1981 | 276.2 | 11.83 | 9.15 | 9.63 |
| Sep 1981 | 276.9 | 12.47 | 9.22 | 9.77 |
| Oct 1981 | 279.3 | 12.78 | 9.35 | 9.91 |
| Nov 1981 | 278.8 | 12.89 | 9.45 | 9.89 |
| Dec 1981 | 280.0 | 12.87 | 9.42 | 10.03 |
| Jan 1982 | 281.9 | 13.14 | 9.53 | 10.11 |
| Feb 1982 | 283.5R | 13.25 | 9.60 | 10.19 |
| Mar 1982 | 284.7R | 13.34 | 9.62 | 10.35 |
| Apr 1982 | 287.5R | 13.46 | 9.79 | 10.48 |
| May 1982 | 288.9R | 13.56R | 9.88 | 10.62 |
| Jun 1982 | 289.8 | 13.71R | 9.92R | 10.69P |
| Jul 1982 | 290.6R | 13.64P | 10.08P | 10.71P |
| Aug 1982 | 290.2 | — | — | — |

P = Preliminary R = Revised since last month

[1] Statistics Canada, Prices Division, Ottawa; "Industry Price Indexes" (Catalogue 62-011), Table 1. Indexes for the most recent six months shown are subject to revision.

[2] Monthly data for 1973 through 1978 appear on page 4.10 of Nuexco Report 138.

[3] Statistics Canada, Labour Division, Employment and Payrolls Section, Ottawa; "Employment, Earnings and Hours" (Catalogue 72-002), Table 2.

[4] Monthly data for 1977 and 1978 appear on page 4.11 of Nuexco Report 138.

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## REPUBLIC OF SOUTH AFRICA STATISTICS

| | Average Declared Working Costs per Metric Ton of Gold Ore Milled (Rand)[1] | Consumer Price Index[2] (1975 = 100, except where otherwise indicated) | Producer[5] Price Index All Groups (1975 = 100) | Total Employment in Mining and Quarrying (Code 35)[7] | Total Salaries and Wages in Mining and Quarrying (1,000 Rand) (Code 40)[7] |
|---|---|---|---|---|---|
| Annual Avg. 1971[3] | 7.88 | 106.4[4] | 59.1 | 652,294 | 415,956 |
| Annual Avg. 1972[3] | 8.79 | 113.3[4] | 63.9 | 623,067 | 443,933 |
| Annual Avg. 1973[3] | 10.51 | 124.1[4] | 72.3 | 684,743 | 572,133 |
| Annual Avg. 1974[3] | 13.18 | 138.5[4] | 85.3 | 674,140 | 761,596 |
| Annual Avg. 1975[3] | 16.71 | 157.2[4] | 100.0 | 639,473 | 1,003,617 |
| Annual Avg. 1976[3] | 19.30 | 174.7[4] | 115.1 | 671,240 | 1,212,983 |
| Annual Avg. 1977[3, 6] | 23.87 | 194.4[4] | 130.0 | 712,006 | 1,420,670 |
| Annual Avg. 1978[3, 6] | 27.14 | 137.2 | 142.7 | 664,571 | 1,537,169 |
| Annual Avg. 1979[3, 6] | 30.18 | 155.3 | 164.5 | 692,209 | 1,830,632 |
| Annual Avg. 1980[6] | 35.53 | 176.7 | 192.1 | 714,379 | 2,279,615 |
| Annual Avg. 1981 | 41.89 | 203.5 | 218.3 | 728,506 | 2,820,505 |
| Apr 1981 | — | 196.4 | 211.6 | 719,674 | 217,124 |
| May 1981 | — | 197.7 | 213.2 | 726,869 | 219,880 |
| Jun 1981 | 40.41 | 200.0 | 215.3 | 728,506 | 237,049 |
| Jul 1981 | — | 204.6 | 218.4 | 735,839 | 249,080 |
| Aug 1981 | — | 208.0 | 222.6 | 722,684 | 245,817 |
| Sep 1981 | 43.28 | 211.6 | 224.6 | 724,604 | 251,502 |
| Oct 1981 | — | 213.4 | 227.0 | 717,918 | 248,159 |
| Nov 1981 | — | 214.8 | 229.4 | 720,255 | 253,044 |
| Dec 1981 | 44.52 | 216.3 | 230.4 | 709,612 | 257,655 |
| Jan 1982 | — | 217.6 | 233.1 | 700,375 | 257,173 |
| Feb 1982 | — | 220.2 | 236.8 | 705,992 | 250,191 |
| Mar 1982 | 45.49 | 225.2 | 237.4 | 725,700 | 262,210 |
| Apr 1982 | — | 228.9 | 241.9 | 707,502 | 252,562 |
| May 1982 | — | 230.3 | 244.8 | 715,162 | 258,770 |
| Jun 1982 | 45.77 | 232.1 | 246.7 | 707,552 | 261,361 |
| Jul 1982 | — | 234.1 | 249.4 | 702,141 | 283,248 |
| Aug 1982 | — | 236.8 | 253.4 | — | — |
| Sep 1982 | 48.04 | 241.0 | 255.0 | — | — |

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[1] Chamber of Mines of South Africa, Johannesburg; "Analysis of Working Results," published quarterly.

[2] Republic of South Africa Department of Statistics, Pretoria; "Government Gazette: Consumer Price Index for Urban Areas."

[3] Historical data for the Average Declared Working Costs and Consumer Price Index 1970-1979 appear on page 4.9 of Nuexco Report 140.

[4] April 1970 = 100.00.

[5] Previously known as the WHOLESALE PRICE INDEX, now the PRODUCER PRICE INDEX. The computation remains the same.

[6] Historical data for Codes 35 and 40 1977-1980 appear on page 28 of Nuexco Report 157.

[7] Bulletin of Statistics, Department of Statistics, Pretoria.

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*STATISTICAL DATA*

## US GOVERNMENT STATISTICS

| | Producer Price Index— Industrial Commodities (1967 = 100)[1] | Producer Price Index— All Commodities (1967 = 100)[1] | Consumer Price Index (1967 = 100)[2] | GNP Implicit Price Deflator (1972 = 100)[3] | Gross Average Hourly Earnings of Production or Non-supervisory Workers (US$)[4] | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Metal Mining (SIC 10) | Primary Non-ferrous Metals (SIC 333) | Chemicals and Allied Products (SIC 28) | Electric and Electronic Equipment (SIC 36) |
| Annual Avg. 1971[5] | 114.1 | 114.0 | 121.3 | 96.01R | 4.12 | 4.15 | 3.97 | 3.49 |
| Annual Avg. 1972[5] | 117.9 | 119.1 | 125.3 | 100.00 | 4.56 | 4.59 | 4.26 | 3.71 |
| Annual Avg. 1973[5] | 125.9 | 134.7 | 133.1 | 105.75R | 4.84 | 4.98 | 4.51 | 3.91 |
| Annual Avg. 1974[5] | 153.8 | 160.1 | 147.7 | 115.08R | 5.44 | 5.63 | 4.88 | 4.21 |
| Annual Avg. 1975[5] | 171.5 | 174.9 | 161.2 | 125.79R | 6.13 | 6.24 | 5.39 | 4.64 |
| Annual Avg. 1976[5] | 182.4 | 183.0 | 170.5 | 132.34R | 6.76 | 6.87 | 5.91 | 4.96 |
| Annual Avg. 1977[5] | 195.1 | 194.2 | 181.5 | 140.05R | 7.28 | 7.67 | 6.43 | 5.39 |
| Annual Avg. 1978[5] | 209.4 | 209.3 | 195.4 | 150.42R | 8.23 | 8.56 | 7.02 | 5.82 |
| Annual Avg. 1979[5] | 236.5 | 235.6 | 217.4 | 163.42R | 9.27 | 9.50 | 7.60 | 6.32 |
| Annual Avg. 1980[5] | 274.8 | 268.8 | 246.8 | 178.64R | 10.26 | 10.63 | 8.30 | 6.94 |
| Annual Avg. 1981 | 304.1 | 293.4 | 272.4 | 195.51R | 11.55 | 11.98 | 9.12 | 7.62 |
| Sep 1981 | 307.4 | 295.7 | 279.3 | 197.36R | 12.10 | 12.70 | 9.38 | 7.75 |
| Oct 1981 | 309.0 | 296.1 | 279.9 | — | 12.08 | 12.44 | 9.37 | 7.80 |
| Nov 1981 | 309.3 | 295.5R | 280.7 | — | 12.12 | 12.48 | 9.42 | 7.83 |
| Dec 1981 | 310.0 | 295.8 | 281.5 | 201.55R | 12.08 | 12.45 | 9.53 | 7.90 |
| Jan 1982 | 311.7R | 298.2R | 282.5 | — | 12.19 | 12.66 | 9.68 | 7.98R |
| Feb 1982 | 311.4R | 298.5R | 283.4 | — | 12.22 | 12.61 | 9.68 | 7.96R |
| Mar 1982 | 311.0 | 298.0 | 283.1 | 203.68 | 12.29 | 12.69 | 9.71 | 8.01 |
| Apr 1982 | 309.9 | 298.0 | 284.3 | — | 12.23 | 12.68 | 9.81 | 8.03 |
| May 1982 | 309.6R | 298.6 | 287.1 | — | 12.25 | 12.71 | 9.83 | 8.05 |
| Jun 1982 | 310.7P | 299.4P | 290.6 | 205.98 | 12.26 | 12.91 | 9.95 | 8.09 |
| Jul 1982 | 313.0P | 300.6P | 292.2 | — | 12.23R | 12.91R | 10.02R | 8.18 |
| Aug 1982 | 313.4P | 300.4P | 292.8 | — | 12.28P | 12.97P | 10.01P | 8.24R |
| Sep 1982 | 312.9P | 299.5P | 293.3 | 208.71 | — | — | 10.20P | 8.32P |

P = Preliminary R = Revised since last month

[1] US Bureau of Labor Statistics, Washington, D.C.; "Producer Prices and Price Indexes," Table 6 (formerly "Wholesale Prices and Price Indexes"). Producer Price Indexes are revised four months after they are first released to reflect the availability of late reports and corrections by respondents.

[2] US Bureau of Labor Statistics, Washington, D.C.; Consumer Price Index for All Urban Consumers, US City Average, All Items.

[3] US Department of Commerce, Washington, D.C.; Bureau of Economic Analysis, National Income and Wealth Division; "Survey of Current Business," Table A. The GNP Implicit Price Deflator is published quarterly, and seasonally adjusted.

[4] US Bureau of Labor Statistics, Washington, D.C.; "Employment and Earnings," Table C-2. All data based on 1972 revision of SIC Manual. Data for 1970-1976 are adjusted to the March 1977 benchmark. Data for 1977-1978 are adjusted to the March 1979 benchmark. Data for January 1979 and beyond are adjusted to the March 1980 benchmark.

[5] Monthly data 1970-1978 for Producer Price Index-Industrial Commodities, Consumer Price Index, and Employment and Earnings SIC codes 10, 333, and 28, and quarterly data for GNP Implicit Price Deflator appear on pages 4.6-4.8 of Nuexco Report 139.
Monthly data 1977-1978 for Employment and Earnings SIC Codes 10, 333, and 28 appear on page 33 of Nuexco Report 147.
Monthly data 1970-1978 for Employment and Earnings SIC Code 36 appear on page 23 of Nuexco Report 154.
Monthly data 1979-1980 for Employment and Earnings, Revised Establishment Data, all listed codes, appear on page 22 of Nuexco Report 158.
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## *OPTIMUM TAILS ASSAY*

### OPTIMUM TAILS ASSAY FOR VARIOUS COMBINATIONS OF FEED AND SWU COSTS

(percent $U_{235}$)

| Feed Cost (US$ per KgU as Natural $UF_6$) | SWU Price (US $ per SWU) | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **90** | **95** | **100** | **105** | **110** | **115** | **120** | **125** | **130** | **138.65** | **140** | **149.85** | **160** | **170** | **180** | **190** | **200** |
| 40 | .316 | .322 | .327 | .333 | .338 | .343 | .347 | .352 | .356 | .363 | .364 | .372 | .379 | .385 | .391 | .397 | .402 |
| 45 | .302 | .308 | .314 | .320 | .325 | .330 | .334 | .339 | .343 | .350 | .351 | .359 | .366 | .373 | .379 | .384 | .390 |
| 50 | .291 | .297 | .302 | .308 | .313 | .318 | .323 | .327 | .332 | .339 | .340 | .347 | .354 | .361 | .367 | .373 | .379 |
| 55 | .280 | .286 | .292 | .297 | .302 | .307 | .312 | .317 | .321 | .328 | .329 | .337 | .344 | .351 | .357 | .363 | .368 |
| 60 | .271 | .277 | .282 | .288 | .293 | .298 | .302 | .307 | .311 | .319 | .320 | .327 | .334 | .341 | .347 | .353 | .359 |
| 65 | .262 | .268 | .273 | .279 | .284 | .289 | .294 | .298 | .302 | .310 | .311 | .318 | .326 | .332 | .339 | .345 | .350 |
| 70 | .254 | .260 | .265 | .271 | .276 | .281 | .285 | .290 | .294 | .301 | .302 | .310 | .317 | .324 | .330 | .336 | .342 |
| 80 | .239 | .245 | .251 | .256 | .261 | .266 | .271 | .275 | .279 | .287 | .288 | .295 | .302 | .309 | .316 | .322 | .327 |
| 90 | .227 | .232 | .238 | .243 | .248 | .253 | .258 | .262 | .266 | .274 | .275 | .282 | .289 | .296 | .302 | .308 | .314 |
| 100 | .216 | .221 | .227 | .232 | .237 | .242 | .246 | .251 | .255 | .262 | .263 | .270 | .278 | .284 | .291 | .297 | .302 |

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# NUEXCO

DECEMBER 1982 NUMBER 172

# Monthly Report on the Nuclear Fuel Market

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# NUEXCO REPORT 172
## EXECUTIVE SUMMARY

**Exchange Value Jumped $2.25, to $19.75**

The **Exchange Value** as of November 30, 1982 is **$19.75** per pound $U_3O_8$. The 13% rise is the second largest percentage increase in history. Nine uranium sales are reported, involving a total of 10 million pounds $U_3O_8$ equivalent. Four long-term deals accounted for 80% of the total.

**Near-term Supply and Demand in Balance. Ratio is 1:1.**

*Active* sellers in the zero to one year time frame are offering 5.2 million pounds $U_3O_8$, up 20% from 4.3 million pounds last month. Even after spot and near-term transactions representing two million pounds were concluded during November, *active uranium demand* jumped to 5.2 million pounds $U_3O_8$ as of the end of the month, more than double last month's level of 2.1 million. The ratio of near-term supply to near-term demand dropped to 1.0:1 this month, less than half of last month's ratio of 2.1:1.

**Transaction Value Increased $0.55, to $17.55**

The **Transaction Value** as of November 30, 1982, is **$17.55** per pound $U_3O_8$. It includes 20 transactions totaling 4.9 million pounds $U_3O_8$ and covers a period of three months.

**Conversion Value Dropped 15 Cents, to $1.45**

The **Conversion Value** as of November 30, 1982, is **$1.45** per pound U as $UF_6$, down fifteen cents from last month. No conversion transactions are reported. Active sellers are offering 2.9 million pounds U as $UF_6$ in near-term conversion services, up 1.2 million pounds since last month. Active demand rose to 1.6 million pounds U as $UF_6$, five times last month's level. The increase was due to the entry of one more buyer.

**Loan Use Charge Rate Steady at 6%**

The **Loan Use Charge Rate** as of November 30, 1982, is **6 percent** per annum. One small transaction is reported.

**Enriched Uranium and SWUs**

Secondary market sellers of DOE SWU for FY 1983 deliveries continued to offer discounts of about $25 per SWU from DOE's AFC price (calculated at .2 tails). Eurodif sellers are offering substantially larger discounts from DOE's AFC price, in the range of $35 per SWU (at .2 tails). Sellers of DOE SWU for delivery in FY 84 continue to offer discounts of $28-$30 from DOE's AFC price (at .2 tails). Offers from Eurodif sellers are made in terms of a base price plus escalation, so they are not directly comparable to those of DOE sellers, because DOE's AFC price for FY 84 delivery is not yet known.

**The Impact of the FR Contract on the Secondary SWU Market**

In the long term, firm commitments to DOE will diminish. There will also be very little excess SWU, so the traditional secondary market activity will be reduced substantially, but it could be replaced by sales of Eurodif SWUs to holders of DOE requirements contracts having 3.5 year termination provisions.

**Australia**

Inflation and high unemployment are causing the governing Liberal party to lose popularity in Australia.

**Canada**

SMDC has obtained Canadian government approval for seven contracts covering a total of 14.5 million pounds $U_3O_8$.

**Germany, Federal Republic**

West German utilities are hopeful that the "Konvoy" system can facilitate the licensing of the next round of German power reactors.

**Japan**

Utilities are expected to demand sharply reduced prices in the upcoming round of annual negotiations with their principal uranium suppliers.

**Raw Materials**

Describes Marline Uranium's Swanson orebody.

**United States**

The proposed uranium import embargo was rejected by the House of Representatives.

The NRC issued two full-power operating licenses and one fuel loading and low power license.

**Analysis and Commentary**

Excerpts of Wayne Fowler's Taipei speech are presented.

Nuexco's latest forecasts of WOCA uranium production are presented. Substantial declines in the US are to be offset only partially by increases in Australia and Canada.

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# NUEXCO REPORT 172

## FIGURES OF THE MONTH

| | This Month | Last Month | 12 Months Ago |
|---|---|---|---|
| | (Referenced to November 30, 1982) | | |
| Exchange Value[1] | 19.75 | 17.50 | 23.50 |
| Transaction Value[1] | 17.55 | 17.00 | 24.10 |
| Conversion Value[2] | 1.45 | 1.60 | 1.20 |
| Loan Use Charge Rate[3] | 6% | 6% | 6% |
| Near-Term Uranium Supply[4] | 5.2 | 4.3 | 7.1 |
| Near-Term Uranium Demand[5] | 5.2 | 2.1 | 3.1 |
| Near-Term Supply-Demand Ratio | 1.0 | 2.1 | 2.3 |
| Current Transactions[6]: | | | |
| Number of Transactions | 9 | 9 | 1 |
| Quantity of Material[7] | 6.1-12.1 | 1.4-3.0 | 0.05-0.1 |
| USDOE SWU Prices[8]: | | | |
| AFC | 138.65 | 138.65 | 130.75 |
| Requirements | 149.85 | 149.85 | 127.59 |
| Optimum Tails Assay[9] | .329 | .341 | .305 |
| Calculated Price of Enriched $UF_6$[10] [11]: | | | |
| 2.5 w/o $U_{235}$ | 693.19 | 668.30 | 709.04 |
| 3.0 w/o $U_{235}$ | 895.97 | 865.68 | 912.30 |
| 3.5 w/o $U_{235}$ | 1,102.91 | 1,067.20 | 1,119.48 |
| 4.0 w/o $U_{235}$ | 1,312.91 | 1,271.79 | 1,329.55 |

---

[1] US $ per pound $U_3O_8$ equivalent

[2] US $ per pound U as $UF_6$

[3] Per annum

[4] Active inquiries to sell, for delivery within 12 months after contract signing (millions of pounds $U_3O_8$)

[5] Active inquiries to purchase, for delivery within 12 months after contract signing (millions of pounds $U_3O_8$)

[6] Uranium transactions only; does not include loans, conversion, or SWU transactions

[7] Millions of pounds $U_3O_8$, equivalent

[8] US $ per SWU

[9] Percent $U_{235}$.

[10] Theoretical calculation based on Exchange Value, Conversion Value, 0.20 percent tails assay and the USDOE price for AFC SWUs.

[11] US $ KgU as $UF_6$

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# MONTHLY REPORT ON THE NUCLEAR FUEL MARKET

December 1982 No. 172

R. WESLEY MILLER, *EDITOR*

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## *FOREWORD*

During an extended tour of the Far East, which took him to Hong Kong, Taipei, Seoul, Tokyo and Manila, Nuexco Vice President Wayne Fowler addressed the sixth annual Joint Business Conference of the ROC-USA Economic Council. Excerpts from his speech are presented in this Report, page 17.

* * *

Nuexco's offices will be closed on December 24 and 31.

## NATURAL URANIUM AND CONVERSION

The **Exchange Value** as of November 30, 1982 is **$19.75** per pound $U_3O_8$, up $2.25 since last month. The upward price pressure first sensed in September, and which clearly manifested itself during October, grew stronger during November, especially during the latter part of the month.

Buying activity was quite vigorous; the *Current Market Data* section lists nine uranium sales transactions, involving approximately ten million pounds $U_3O_8$, equivalent. The four long-term transactions accounted for approximately 80 percent of that amount, while five spot or near-term transactions accounted for the balance.

* * *

**Active uranium supply** (material offered at competitive prices, terms and other conditions) amounts to **5.2 million pounds $U_3O_8$**, equivalent, in the near term, an increase of almost one million pounds from last month's level of 4.3 million. Even after spot and near-term transactions representing two million pounds $U_3O_8$ were concluded during the month of November, **active uranium demand** for spot or near-term delivery jumped to **5.2 million pounds $U_3O_8$**, equivalent, a 150 percent increase. Therefore, the **supply-demand ratio** declined to 1.0:1, the first time in recent memory that the demand component has equalled or surpassed the supply figure.

* * *

The **Transaction Value** as of November 30, 1982 is **$17.55** per pound $U_3O_8$, up $0.55 from a month ago. The current Transaction Value includes 20 transactions totaling 4.9 million pounds $U_3O_8$ and covers a period of three months. The time lag built into Transaction Value prevented it from reflecting all of the upward price movement which occurred during November, because it is heavily influenced by transactions reported in September and October, when prices were substantially lower.

* * *

The **Conversion Value** as of November 30, 1982 is **$1.45** per pound U as $UF_6$, down fifteen cents from a month ago. However, the thin secondary conversion market remains very volatile. Five active sellers are competing for orders from only two active buyers. Sellers intensified competition by reducing their offering prices in the latter part of the month. **Active offers to sell conversion services** in the near term amount to approximately **2.9 million pounds U as $UF_6$**, an increase of 1.2 million pounds U since last month. **Active conversion demand** rose to **1.6 million pounds U as $UF_6$**, five times last month's level. All of the increase was due to the entry of one buyer of a large quantity. In a market having so few participants, such apparently dramatic changes in supply and demand are not necessarily meaningful. What is meainingful, however, is the fact that any single buyer or seller can have even more significant influence on the secondary conversion market than is the case in the spot/near-term market for uranium.

* * *

The **Loan Use Charge Rate** remained at six percent per annum. The limited activity in the market is at or near that level, but there are very few participants. One small loan transaction is reported in the *Current Market Data* section.

* * *

This month's 13 percent increase in the Exchange Value is the second largest percentage increase in history, exceeded only by a 17 percent jump in December 1975 ($30.00 as of November 30 to $35.00 as of December 31.

Several factors contributed to the price rise.

1. As noted last month in Report 171, the most aggressive sellers have largely completed sales campaigns begun earlier in the year. With sellers demanding higher prices, buyers, whose appetites had been whetted by the prospect of bargain purchases, suddenly began to find a more difficult market and, in turn, had to become more aggressive to complete desired transactions. The sellers also sensed the shifted market dynamics and moved their offering levels higher.
2. Last month's fifty cent increase in the Exchange Value (from $17.00 to $17.50 per pound $U_3O_8$) appears to have been viewed by both buyers and sellers as a signal that spot prices have bottomed and are rebounding upward.
3. Expectations that the proposed uranium embargo would be enacted may have been a contributing factor.
4. Market activity that has taken place near the end of most years added impetus to this month's upward price pressure. Two purchases of odd lots (less than 100,000 pounds $U_3O_8$) were made, and prices in that type of transaction are beginning to edge upward. In a sense, prices for odd-lot transactions can be regarded as indicative of the type of market that exists. For example, in a buyers' market, prices for odd-lot transactions may

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very well be lower than those for larger quantities, as a result of the buyers' greater relative market strength. On the other hand, in a sellers' market, a buyer who needs to satisfy a certain set of conditions, such as a small quantity of material in the form of $U_3O_8$ of US origin, for immediate delivery at a particular converter may well have to pay more to meet all of these specified requirements than would a buyer interested in adding to inventory generally, without particular regard to national origin, location or timing.

5. More than 90 percent of current buying is being done by utilities adding to inventory which, in some cases, won't be utilized until the late 1980s and, in at least one case, until after 1990. Such behavior suggests that these buyers believe that purchases at the current spot market price plus carrying charges will turn out to be less expensive than waiting to purchase nearer time of actual use in a reactor. These buyers are indicating their judgments that uranium prices, in constant dollars, will rise substantially in the longer term. Such inventory purchases would be expected to continue (while cash remains available at relatively favorable terms) until the spot prices begin to approach the present value of expected future prices.

The psychological aspects of spot price movements are substantial and predictions as to duration and magnitude of any particular move are often more intuitive than objective. It would be easy to speculate that, in view of the existing momentum, the current move will carry further. However, the House of Representatives' decisive defeat of the proposed US uranium import embargo could have the opposite effect. To forecast a sustained price rise would be premature at this juncture.

## ENRICHED URANIUM AND SWU

The short-term secondary SWU market remains quite active. A number of US and non-US DOE requirements contracts holders who terminated deliveries are actively soliciting offers for replacement material from secondary market sources of both DOE and Eurodif SWUs.

Discounts offered by DOE secondary market sellers for FY 1983 deliveries remained unchanged from last month, at about $25 per SWU from DOE's AFC price when calculated at .2 tails. Discounts offered from DOE's price for AFC SWUs being offered by Eurodif sellers are substantially more, in the range of $35 per SWU at .2 tails. A number of US utilities have recently expressed strong interest for the first time in investigating purchases of Eurodif SWU due to the price differential.

Discounts for DOE SWU in FY 1984 remain unchanged at about $28-30 per SWU from AFC price at .2 tails. Offers from Eurodif sellers are made in terms of a base price plus escalation, and cannot easily be compared to the offers of DOE sellers since the DOE FY 1984 AFC price is not yet known. It would appear, however, that the offers by Eurodif sellers will result in a significantly lower purchase price in FY 1984 than is available for DOE SWU.

The market for DOE SWU for delivery for FY 1985 and later remains almost non-existent as potential sellers await DOE's announcement of the terms and conditions of conversion to the FR contract.

* * *

## THE IMPACT OF THE FR CONTRACT ON THE SECONDARY SWU MARKET

### Introduction

The secondary SWU market has undergone dramatic changes in the past few years due to changes in the contracting policies of USDOE. The latest contracting change, the introduction of the FR contract, can be expected to cause further major changes in the secondary SWU market. In order to understand the significance of the introduction of the FR contract, it is important first to obtain some perspective by reviewing the reasons for development of the SWU market that now exists.

### Development of the Market

There was virtually no secondary SWU market under the Requirements contract. There was no need for a secondary market, since no customer had excess SWU commitments to sell. A customer simply specified a desired delivery six months in advance, and no delivery was scheduled unless it was actually needed. Buyers had no choice but to obtain the material from a primary supplier.

The introduction of the LTFC contract, with its ten-year rolling firm commitment period, created the need for a secondary market to dispose of excess commitments created by reactor construction delays. But there was as yet no real secondary market. Most potential buyers seeking new commitments simply continued to seek those commitments directly from primary suppliers. Some secondary market transactions did take place, but they were limited in number and were partly in response

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to the US government's temporarily closing the order books for US enrichment services.

It was only with the introduction of the AFC contract, and DOE's official reopening of the US enrichment order books, that a real secondary SWU market as it now exists was created. DOE chose to provide contract relief to customers with excess commitments by announcing liberalized schedule adjustment provisions for conversion of existing LTFC contracts to the AFC form. Wholesale schedule readjustments were made upon conversion, and some customers found themselves suddenly able to seek new supply while others were seeking even more economic ways to dispose of excess commitments. Sellers and buyers began to be influenced to look to the secondary market as a viable and economic option to assist in these schedule readjustments.

The secondary market created by the AFC contract policies became almost exclusively one of partial contract assignments between one DOE customer and another. DOE's policy allows new and existing customers to reduce the amount of enrichment services taken from DOE by the same amount obtained on the secondary market from another DOE customer. This mechanism was used extensively to the advantage of both potential buyers and sellers. Discounts available were in the $2 to $3 per SWU range, and the market appeared to be in approximate balance.

As the AFC conversions and schedule adjustments were completed, and the number of new contracts being signed steadily decreased, demand for short-term SWU on the secondary market began shrinking rapidly. A strong short-term buyers' market began to develop as sellers began competing for the few available buyers. Discounts escalated to the $30 per SWU range, and more. As discounts increased, a flood of new buyers—DOE customers partially terminating the older requirements contracts containing 3.5 year termination provisions—entered the market, effectively putting a ceiling on discounts. Since then, discounts have decreased slightly to about the $28 per SWU range, where the market stands today.

At the same time, the number of long-term sellers with excess SWU commitments far out in time who need to dispose of them has been decreasing substantially. There are few customers with excess commitments after about 1987 or 1988 that have not already made some accommodations to use up the commitments, such as arrangements to pool with other reactors. There were, for example, more buyers wishing to take assignment for FY 1988 SWU on the secondary market than there were potential assignors wishing to complete such transactions.

**Effects of the FR Contract**

The driving force of the secondary SWU market has always been the need to dispose of excess DOE commitments. The long-term effects of the FR contract will, therefore, depend on the effect the new contract has on the amount of excess SWU commitments. The short-term effects cannot be known until DOE announces the terms and conditions of conversion. The long-term effects, however, are apparent from a quick review of the contract's terms and conditions.

The FR contract contains a 2-year rolling firm commitment period rather than the 5-year period of the AFC contract. As a result, the amount of firm commitments made by customers to DOE will be drastically reduced. AFC customers, for example, were required on July 1, 1982, to specify firm commitments to DOE for FY 1988 if their contracts did not already contain such as part of an initial delivery period. Under the new FR contract, firm commitments for FY 1988 in such a case would not have to be made until April 1, 1986.

If, as expected, most AFC customers choose to convert to the FR form, in the long run there will be much less excess SWU that could be available for sale on the secondary market. Some excess commitments will continue to exist due to unexpected reactor startup delays and outages. But DOE customers will not be faced with the possibility of selling or possibly carrying unneeded inventory for 6 years or more. At most, a customer could be faced with 3 years of unneeded commitments. As a result, the economic attraction of selling as against buying and holding will be reduced. Therefore, the discounts offered by potential sellers will be much less than at present.

On the demand side, the long-term effect of the FR contract will be to tend to decrease secondary market activity. The FR contract states that DOE must be given 30 months notice if a customer is to reduce the amount of enrichment services taken from DOE directly by buying DOE SWU on the secondary market. Under steady state conditions, there would be no FR contract holders with firm commitments that far ahead. Sellers would have to come from any remaining LTFC or AFC contract holders, or inventory holders who had not yet been able to sell material. Also, the attractiveness to the buyer of taking material on the secondary market is greatly reduced, since commitments to purchase on the secondary market would have to be made in advance of

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*PRICING*

normal commitments made to DOE. It is questionable whether there would be any sellers offering discounts making it worthwhile for a secondary market buyer to accept this increased scheduling risk.

Requirements contract holders will most likely find discounts offered by DOE sellers to be too low to allow economic termination of requirements contract deliveries and their replacement with secondary market SWU. If such buyers are to continue their secondary market activity, they will most likely have to begin purchasing replacement SWU from Eurodif sellers.

Under long-term equilibrium conditions following wholesale conversion to the FR contract, there seems to be little room for the existence of the traditional DOE customer-to-DOE customer secondary SWU market that exists today. Its most likely replacement will be a new secondary market driven by Eurodif excess SWU commitments, with the most likely buyers being the DOE customers with the old requirements contracts containing 3.5 year termination provisions.

The short-term effect of the conversion to the FR contract on the secondary SWU market will depend on the terms and conditions of conversion, which DOE is expected to announce in the spring. There may be a short-term burst of activity, similar to that which occurred with conversion to the AFC contract. The immediate effect on the demand side should be to increase the number of potential intermediate term buyers, due to the sudden shortening in the commitment period. Whether there will be many secondary market sellers to meet that demand will depend on the terms and conditions of schedule adjustment offered with conversion.

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**EXCHANGE VALUE $19.75/lb. $U_3O_8$**
Determined as of November 30, 1982

**Definition**[1]

The Exchange Value is Nuexco's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the last day of the month.

**Derivation**

Nuexco bases the Exchange Value upon:

A. Data from recently completed transactions.
B. Data from pending transactions.
C. Firm bids to buy and firm offers to sell.
D. Prices purchasers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy, and prices sellers have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell.

**Comments**

Nuexco does not consider the following in determining the Exchange Value:

A. The price of uranium delivered or to be delivered under old contracts.
B. The price of uranium delivered in connection with contract renegotiations or other than arm's length transactions.

[1] In December, 1981, Nuexco published a history of the Exchange Value which chronicled, month-by-month, changes in its definition, usage and derivation. Copies are available upon request.

**TRANSACTION VALUE**[2]
Determined as of November 30, 1982

| $/lb. $U_3O_8$ | Millions of Pounds | Number of Transactions | Number of Months |
|---|---|---|---|
| 17.55 | 4.9 | 20 | 3 |

**Definition**

The Transaction Value is a weighted average price of recent transactions, and is based on prices paid for $U_3O_8$ in transactions closed within the previous three-month period and for which delivery was scheduled within one year of the transaction date. At least ten transactions totaling at least two million pounds $U_3O_8$ are included in each calculation, or the sample time is extended as necessary to include these minima. Foreign currencies are converted to US dollars as of the transaction date.

**Comments**

Nuexco does not consider the following in determining the Transaction Value:

A. The price of uranium delivered in connection with contract renegotiations or other than arm's length transactions.
B. The price of uranium delivered in connection with contracts which call for "market price" mechanisms. This exclusion applies particularly to contracts in which delivery prices are expressed as a function of Exchange Value or any other independent variable. Also excluded from consideration are all data where the delivery price is defined in such a way that it cannot currently be determined.

[2] Transaction Values for 1976 through 1981 and their associated parameters (millions of pounds, number of transactions and number of months) are tabulated on pages 31 and 32 of Report 161.

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*CURRENT MARKET DATA*

**CONVERSION VALUE $1.45/lb. U as $UF_6$**
Determined as of November 30, 1982

**Definition**

The Conversion Value is Nuexco's judgment of the price at which spot and/or near-term transactions for significant quantities of conversion services could be concluded in the secondary market as of the last day of the month.

**Derivation**

Nuexco bases the Conversion Value upon:

A. Data from recently completed transactions.
B. Data from pending transactions.
C. Firm bids to buy and firm offers to sell.
D. Prices purchasers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy, and prices sellers have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell.

**Comments**

Nuexco does not consider the following in determining the Conversion Value:

A. The price of conversion services delivered or to be delivered under old contracts.
B. The price of conversion services delivered in connection with contract renegotiations or other than arm's length transactions.

**LOAN USE CHARGE RATE[1] 6%**
Determined as of November 30, 1982

**Definition**

The Loan Use Charge Rate is Nuexco's judgment of the annual interest rate at which uranium loans could be concluded as of the last day of the month.

**Derivation**

Nuexco bases the Loan Use Charge Rate upon:

A. Data from recently completed or pending loan transactions.
B. Rates included in firm proposals to borrow or lend.
C. Rates that potential borrowers and lenders have expressed as a willingness to pay or accept, but for which Nuexco is not aware of firm proposals.

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[1] Monthly data for 1968 through 1981 appear on pages 32-34 of Report 162.

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## TRANSACTION SUMMARY[1]

### Uranium Transactions

| Nuexco Reference Number | Delivery Period | Approximate Quantity (thousands of pounds, $U_3O_8$ equivalent) | Approximate Price as Percent of Current E.V. | Seller | Buyer | Remarks |
|---|---|---|---|---|---|---|
| 2011 | 1983 | 301-600 | 89 (est.) | Broker | European Utility | $UF_6$ |
| 2021 | 1984-91 | 601-1000 | indeterminate | Canadian Producer | US Utility | Price related to market. Pending required govt. approval |
| 2023 | 1983-89 | 1001-2000 | Less than 90 | US Producer | US Utility | Price related to market |
| 2025 | 1990-2000 | 2001-3000 | indeterminate | African Producer | Far East Utility | Price related to market |
| 2030 | 1983 | 1001-2000 | 92 | US Utility | European Utility | $UF_6$ |
| 2031 | mid-1980s | 1001-3000 | indeterminate | Canadian Producer | European Utility | Price related to market. Pending required govt. approval |
| 2041 | 1983 | 51-100 | 100-102 | US Producer | US Producer | |
| 2048 | 1983 | Less than 50 | 92-94 | US unidentified | US Utility | |
| 2057 | 1983 | 101-300 | 110 | US Producer | US Producer | |

### Conversion Transactions

| Nuexco Reference Number | Delivery Period | Approximate Quantity (thousands of pounds, U equivalent) | Approximate Price as Percent of Current C.V. | Seller | Buyer | Remarks |
|---|---|---|---|---|---|---|

There are no conversion transactions reported this month.

### Loan Transactions

| Nuexco Reference Number | Delivery Period | Approximate Quantity (thousands of pounds, $U_3O_8$ equivalent) | Approximate Price as Percent of Current L.U.C.R. | Lender | Borrower | Remarks |
|---|---|---|---|---|---|---|
| 2042 | 1982 | Less than 50 | 108 | US Utility | US Producer | |

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[1] Transactions listed are not limited to those in which Nuexco was involved, but also include others of which Nuexco is aware.

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*CURRENT MARKET DATA*

## URANIUM SUPPLY
## (As of 11/30/82)

| Nuexco Reference Number | Delivery Period[1] (Thousands of Pounds $U_3O_8$) |  | Remarks |
|---|---|---|---|
|  | 0 to 1 Year | Beyond 1 Year |  |
| **Available for Sale:** |  |  |  |
| **ACTIVE** |  |  |  |
| 1575 |  | 500 per year | Long Term |
| 1909 | 1,100 |  | $UF_6$ |
| 1925 | 500 |  | $UF_6$ |
| 2020 |  | 200 per year | 1983-92 |
| 2027 | 700 |  |  |
| 2038 | 1,500 |  | UF6 |
| 2056 | 1,400 |  | $UF_6$ |
| TOTAL: | 5,200 |  |  |
| **INACTIVE** |  |  |  |
| 1581B |  | 100 per year | Long Term |
| 1610 | 20 |  |  |
| 1804 | 615 |  |  |
| 1805 |  | 500 per year | Long Term |
| 1818 |  | 250 per year | Long Term |
| 1877 | 100 |  |  |
| 1928 | 1,000 |  | $UF_6$ |
| TOTAL: | 1,735 |  |  |

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[1] Measured from the date of this Report

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## URANIUM DEMAND
### (As of 11/30/82)

| Nuexco Reference Number | Delivery Period[1] (Thousands of Pounds $U_3O_8$) | | Remarks |
|---|---|---|---|
| | 0 to 1 Year | Beyond 1 Year | |
| **Inquiries to Purchase:** | | | |
| **ACTIVE** | | | |
| 1871 | | 250 per year | 1983-86 |
| 1985 | 100 | | |
| 1995 | 250 | | |
| 1996 | | 600 | |
| 2000 | | 250 | |
| 2010 | | 400 per year | 1984-92 |
| 2014 | 160 | | |
| 2030 | | 1,350 | 1984-85 |
| 2031 | 1,000 | | $UF_6$ |
| 2032 | | 200 | |
| 2042 | | 400 per year | Long Term |
| 2047 | 40 | | |
| 2050 | 30 | | $UF_6$ |
| 2054 | 110 | | |
| 2055 | 400 | | |
| 2059 | 2,200 | | |
| 2060 | 225 | | $UF_6$ |
| 2061 | 50 | | |
| 2105 | 600 | | $UF_6$ |
| 2110 | | 300 | $UF_6$ |
| TOTAL: | 5,165 | | |
| **INACTIVE** | | | |
| 1459 | | 200 per year | Long Term |
| 1652 | | 200 per year | Long Term |
| 1843 | 250 | | |
| 1888 | | 500 per year | Long Term |
| 1963 | | 50 | |
| 1966 | 100 | 200 | |
| 1999 | | 50 per year | 1985-90 |
| 2004 | 100 | | |
| 2005 | | 1,000 | |
| 2025 | | 330 | |
| TOTAL: | 450 | | |

[1] Measured from the date of this Report.

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## CONVERSION SUPPLY
### (As of 11/30/82)

| Nuexco Reference Number | Delivery Period[1] (Thousands of Pounds U as $UF_6$) | | Remarks |
|---|---|---|---|
| | 0 to 1 Year | Beyond 1 Year | |
| **ACTIVE** | | | |
| 1607 | 300 | | |
| 1609 | 500 | 1,500 per year | Long Term |
| 1840 | 130 | | |
| 1936 | 1,000 | 200 per year | Long Term |
| 2051 | 1,000 | | |
| TOTAL: | 2,930 | | |
| **INACTIVE** | | | |
| 1902 | | 350 | |
| 1925 | 450 | | |
| 2008 | 800 | 800 | |
| TOTAL: | 1,250 | | |

## CONVERSION DEMAND
### (As of 11/30/82)

| Nuexco Reference Number | Delivery Period[1] (Thousands of Pounds U as $UF_6$) | | Remarks |
|---|---|---|---|
| | 0 to 1 Year | Beyond 1 Year | |
| **ACTIVE** | | | |
| 1995 | 220 | | |
| 2058 | 1,400 | | |
| TOTAL: | 1,620 | | |
| **INACTIVE** | | | |
| 1594 | | 450 per year | Long Term |
| 1622 | | 700 | |
| TOTAL: | | | |

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[1] Measured from the date of this Report.

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## LOAN SUPPLY AND DEMAND
(As of 11/30/82)

| Nuexco Reference Number | Delivery Period[1] (Thousands of Pounds $U_3O_8$) 0 to 1 Year | Beyond 1 Year | Remarks |
|---|---|---|---|
| **Available for Loan:** | | | |
| **ACTIVE** | | | |
| 1938 | 2,000 | | |
| 2006A | 600 | | |
| 2036 | 200 | | |
| TOTAL: | 2,800 | | |
| **INACTIVE** | | | |
| 1815 | 1,000 | | $UF_6$ |
| 1884 | 600 | | |
| 1910 | 1,000 | | |
| 1931 | 600 | | |
| 2040 | 500 | | $UF_6$ |
| TOTAL: | 3,700 | | |
| **Inquiries to Borrow:** | | | |
| **ACTIVE** | | | |
| 1998 | 200 | 200 | |
| 2006 | 600 | | |
| TOTAL: | 800 | | |
| **INACTIVE** | None | | |

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[1] Measured from the date of this Report

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## RECENT DEVELOPMENTS

### AUSTRALIA

The recently released Western Mining Corporation (WMC) preliminary EIS (Environmental Impact Statement) on Roxby Downs contained the following figures, among others:

1. For planning purposes it states annual production as 150,000 tonnes of copper; 3,000 tonnes $U_3O_8$; 3,400 Kg of gold and 23,000 Kg of silver. At those rates, the project would rank among the ten largest copper producers in the world.
2. Value of production could be between A$450 million and A$660 million, depending on metal prices.
3. Total project costs are given as at least A$1.4 billion. The project will require a construction workforce peaking at 3,000 and will eventually employ 2,400 people.
4. Under most optimistic assumptions, construction could begin in 1985, bringing first production in 1989. Uranium, although a byproduct, is a vital determinant to the economic viability of the project.

* * *

Inflation and high unemployment are causing the governing Liberal party to lose popularity in Australia. Over the twelve months ended in September of this year, the inflation rate averaged 12.3 percent. Unemployment has increased by one-fifth, to affect 7.8 percent of the nation's work force. Furthermore, the figure of 540,000 unemployed is expected to rise in early 1983 to nearly 700,000, equivalent to an unemployment rate of approximately 10 percent. This trend would seem to strengthen the Labor party's prospects in the next federal election, little more than a year away.

In South Australia's recent state elections, the Labor party defeated the Liberals by a three-seat margin in the lower house. The Labor party's performance in South Australia will be watched closely over the next year, especially with respect to the implementation of its recently modified policy on uranium mining and export.

As discussed in Report 168, the complicated and seemingly contradictory language of the Labor policy allows for various interpretations. A most significant aspect of the new policy is the increased latitude allowed to the party's governing officials. The party is no longer committed to repudiate export contracts and to close uranium mines. Therefore, their actions while in office in South Australia may give some indications of the ways in which the policy might be implemented if the Labor party were to come to power on the federal level. However, the results of last week's by-election indicate that the electorate may be not yet ready to entrust the government to the Labor party, despite the country's current economic difficulties.

During the South Australia campaign, the state's Labor party leader, the Hon. Mr. J.C. Bannon, pledged to allow uranium mining at Roxby Downs. Undoubtedly, his statements were influenced by the potential economic benefits that the development of Roxby Downs would bring to the state. WMC's release last month of the preliminary EIS for Roxby Downs also played a part.

Meanwhile, political infighting continues within the ranks of the Labor party over the policy changes adopted last August. Those of a more ideological persuasion continue to lobby for a return to the old hard line position which committed the Labor party to a moratorium on uranium projects and repudiation of existing contracts.

The federal executive of the Labor party turned down a proposal from the Victoria state branch to convene a special conference in order to revert to the older tougher stance. Now the Tasmanian state Labor party has joined the Victoria branch in calling for a special national conference on this issue. If two more state branches join the call, a special conference must be convened under Labor party rules. Leading members of the federal executive are in favor of uranium mining and so are 56 percent of Labor voters, according to an opinion poll three months ago.

One must remember that the development of Roxby Downs is governed by state legislation which would normally be binding on the government unless the new Labor government decided to change it. Realistically, one can assume, based on campaign pledges, that the new government will take a practical approach to the importance of the Roxby Downs development for the state's economy.

* * *

The Uranium Enrichment Group of Australia (UEGA) has not yet ruled out South Australia as a possible enrichment plant site on account of Labor's election victory in that state, but the Group has acknowledged that it could not build a plant in a state whose government was opposed to such a project. UEGA will commence a worldwide study of the enrichment market next year, but seems to be in no hurry to complete it. Based on the results of the market survey, they will determine when to proceed with the planned full-scale feasibility study.

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## CANADA

SMDC announced that the Canadian government has approved SMDC sales contracts totaling 14.5 million pounds $U_3O_8$. The press release stated that "SMDC's share of the Key Lake project is largely committed through 1986 and is approximately 75 percent committed for the period from the startup until 1990." This would presumably mean that SMDC has commitments for 75 percent of their half interest in Key Lake's planned capacity of 12 million pounds per year, or 4½ million pounds $U_3O_8$ per year. If the press release statement were based on a different capacity figure, the actual quantity involved would be proportionately different.

Based upon public information, arithmetic, and some educated guesses (and no confidential information whatsoever), the SMDC sales situation out of Key Lake shapes up as indicated in Table 1.

**Table 1**

**SMDC SALES COMMITMENTS FROM KEY LAKE**
**(thousands of pounds $U_3O_8$ equivalent)**

| **Approved Contracts** | **1983** | **1984** | **1985** | **1986** | **1987** | **1988** | **1989** | **1990** |
|---|---|---|---|---|---|---|---|---|
| Sydkraft (Sweden) | 325 | 325 | 325 | 325 | 325 | 325 | 325 | 325 |
| SSPB (Swedish State Power Board) | 710 | 710 | 710 | 710 | 710 | 710 | 710 | 710 |
| Yankee Group (US) | | | 200 | 400 | 400 | 400 | 400 | 400 |
| Commonwealth Edison (US) | 1,000 | 1,000 | 1,000 | 1,000 | | | | |
| Other (Non-US) | 500 | 800 | 800 | 800 | 800 | 800 | 800 | 800 |
| **Under Negotiation** | | | | | | | | |
| US Buyers | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 |
| TOTAL | 2,935 | 3,235 | 3,435 | 3,635 | 2,635 | 2,635 | 2,635 | 2,635 |

Obviously, Table 1 shows only part of the picture. There must be other commitments that are not shown. The other two Key Lake partners have also made substantial sales in the neighborhood of 2 to 3 million pounds per year from Key Lake production. All of these sales have been concluded by the partners in the last three years.

* * *

**Correction**

Last month's Report (#171) section on Canada contained two errors. We stated that "SMDC acquired its existing interests in the Key Lake and Cluff Lake deposits" under the Saskatchewan mandatory participation regulations. SMDC's interests were actually acquired prior to the implementation of those regulations, which are, in any event, now repealed.

The second error involves the payment of provincial taxes and royalties by government entities such as Eldorado and SMDC. We mistakenly assumed that as government entities they would "pay neither taxes nor royalties to the province." This is incorrect. All uranium producers in Saskatchewan, including Eldorado subsidiaries and SMDC, pay royalties to the province. Eldorado does not pay Provincial Corporate Income Taxes and SMDC does not pay Federal Corporate Income Taxes. Private corporations pay both. Crown corporations, provincial corporations, and private corporations are all taxed somewhat differently, but each pays a variety of taxes and duties. Since they are taxed differently, it can be argued that one has an advantage over the other, but neither seems to have a significant advantage and there is no reason to believe that the province suffers a financial loss because of Eldorado or SMDC's presence as uranium producers in the province.

It has been widely known and reported in the province that Saskatchewan's Minister of Energy and Mines had a strong preference for private sector uranium development and objected to Eldorado's recent purchase of the Gulf Minerals property and facilities in Saskatchewan. This objection was apparently not for financial, but for philosophical reasons.

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## *RECENT DEVELOPMENTS*

### EUROPE

Utilities in the **Federal Republic of Germany** remain hopeful that the licensing of the next round of German power reactors will be aided significantly by the adoption of a standardized plant. The concept is referred to as the *"Konvoy."*

Under German law, primary responsibility for nuclear plant licensing is vested in the states. As a result, there is much duplication of bureaucracy, and a broad spectrum of regulatory results. The Konvoy concept is intended to remedy this situation. All the plants involved in the Konvoy would be identical, i.e., 1300 MWe class (PWRs) pressurized water reactors manufactured by Kernkraftwerk Union (KWU). In addition, the secondary sides would be identical, to the extent possible. The states involved in the licensing would agree beforehand that only one review for all the plants involved would take place. The state regulatory authorities would then divide the workload *by function*, not by individual plant. For example, the officials in Bavaria would not focus particularly on the Isar Unit, which is located there, but would instead handle one safety or environmental aspect of licensing for all the Konvoy plants.

The final agreements among the states, the utilities, and the manufacturers involved are not yet in place, although indications thus far appear promising. The timing of the final implementation will probably depend on whether there is a federal election called in March 1983, whether the election will take place at its normally scheduled time of late 1984. If the election were held earlier than scheduled, its results would also be a factor.

The ruling coalition of the Christian Democrats and the Free Democrats assumed power in the autumn of 1982 as a result of a Parliamentary transition, the first in the history of the Federal Republic of Germany (FRG). The coalition had previously stated its intention to hold an early election to allow the public to ratify the transition. However, there are now indications this might not happen.

The Christian Democratic Party is thought to be generally pro-nuclear, and its continued presence in power would probably enhance the prospects for adoption of the Konvoy concept.

Table 2 lists the plants which might be included in the Konvoy plan. Isar Unit 2 and Lingen will probably be the first in the schedule. Neckar Unit 2 will also very likely be a Konvoy unit; it has just been awarded the third *first-part construction permit* to be issued in the FRG since late July of this year. Wyhl is also a possibility; Biblis C will likely be included if the need for power in the RWE (Rheinisch-Westphaelisches Elektrizitaetswerk) system allows for a new nuclear plant to be built on a schedule comparable to the other plants in the Konvoy. The Hamm and Brokdorf units are also possibilities for inclusion if the states involved go along with the concept, and if timely need for power is indicated.

**Table 2**

**POSSIBLE "KONVOY" UNITS
FEDERAL REPUBLIC OF GERMANY**

| Plant | Principal Utility(s) | Planned Startup |
|---|---|---|
| Isar 2 (Ohu) | Bayernwerk | 1988 |
| Lingen (Emmsland) | VEW | 1988 |
| Neckar 2 | GKN | 1990 |
| Wyhl (Sued) | Badenwerk/EVS | 1990 |
| Biblis C | RWE | 1990 |
| Hamm (Uentrop) | VEW | 1990 |
| Brokdorf | NWK/PREAG | 1990 |

* * *

**France** has agreed to replace the US as the supplier of enriched uranium for India's Tarapur nuclear station. France has, in effect, taken the place of the US under the 1963 agreement, which the US could no longer honor since the enactment of the Nuclear Nonproliferation Act of 1978.

For nearly four months the French had tried unsuccessfully to impose the London Nuclear Suppliers' Club's supplementary controls. India has agreed in writing to use French nuclear materials and their byproducts for peaceful purposes, but it is difficult to see how this can be enforced. Further, the question of what safeguards apply after 1993 when the contract runs out has been left pending subject to further talks.

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## FAR EAST

### Japan

Annual price negotiations between Japanese utilities and their principal overseas uranium suppliers are beginning with a view towards being completed by mid-1983. Depending on the particular supplier, these negotiations relate either to 1983 or 1984 deliveries. Those negotiating with respect to 1983 delivery prices include ERA (Energy Resources of Australia) and Queensland Mines from Australia, Denison from Canada, Uranex from France and OURD from Niger. Those negotiating for 1984 delivery prices include NUFCOR from South Africa and the RTZ group comprising Rossing from Namibia, Mary Kathleen from Australia, and Rio Algom from Canada.

It seems likely, and in fact is reported, that the negotiations will be difficult this year with the Japanese seeking sharply lower prices based on a number of factors including: the well-recognized oversupply situation; the sharply lower spot prices that prevailed during 1982; and lower utility earnings. The mid-year financial reports of Kansai show profitability down 62 percent compared to a year ago and, for Shikoku, down 13 percent for a comparable period. The unfavorable (from the Japanese viewpoint) movement of the yen-to-US dollar exchange rate is also suggested as another factor supporting a price reduction.

Although 1982 delivery prices (negotiated in 1980 and 1981) are in the range of US$ 35.00 to 40.00, the opening Japanese position this year could well be as low as $25.00. The suppliers can be expected to resist such an extreme downward adjustment and argue that the collapse of spot market prices in 1982 was an anomaly caused by inventory liquidations, which should have no bearing on the appropriate prices for long-term supply arrangements with primary producers. Final settlement prices will, nevertheless, be influenced to some degree by the course of the spot market in the months ahead and the supplier view that, regardless of market developments, US$30 is an *absolute* minimum.

The Ministry of International Trade and Industry (MITI) continues to evaluate the Japanese uranium stockpile situation. The factors being evaluated as part of the study indicate an interest in enhancing the national security by assuring that uranium in their possession will be sufficient to overcome the effects of contract breach, trade embargoes, force majeure or balance of payment disputes. The impetus for the study is prompted by the present market price for uranium and uranium services.

### Korea

The Korean government has established the organization for a fuel fabrication company. The company, whose major positions will be filled from Korea Electric and the Korea Atomic Energy Research Institute, will investigate the licensing of various fabrication processes along with the technology for local production of various fuel components.

## UNITED STATES

The House of Representatives has rejected the proposed US uranium import embargo by a vote of 241-148. The embargo measure had been attached to the compromise NRC authorization bill, which had lacked only House approval before being sent to President Reagan for signature. The embargo amendment fell short of approval by 20-30 votes, but once its defeat was assured, some Representatives voted against it so as to avoid offending the Reagan administration, which had strongly opposed the embargo.

The NRC authorization bill, intact except for the embargo amendment, will probably go back to the Senate for its approval. It would be very difficult to convene another House-Senate conference committee this late in the "lame-duck" session of Congress, so the embargo issue is almost certainly dead, at least until the next session. To reopen the issue then would mean starting over with a new piece of legislation.

Supporters of the embargo have raised the possibility that Senator Domenici, its primary legislative proponent, might try to force his colleagues to support the embargo in exchange for his support for administration efforts to relax federal controls on uranium mill wastes.

It is not yet clear what impact the House defeat of the embargo amendment will have on the uranium market. On one hand, it could dash the hopes of producers and like-minded utilities for the production of ample supplies of domestic uranium by a government-protected US uranium industry. In that event, much of the recent upward pressure on uranium prices might dissipate. On the other hand, the *threat* of an embargo may have the same effect on prices as the *enactment* of one might have done. Under that scenario, US producers would adopt tough negotiating postures and US utilities would have an acceptable rationale for accepting higher prices for domestic production. In that case, a two-tier pricing system could result. In either event, the issue is likely to remain uncertain for some months to come.

* * *

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## *RECENT DEVELOPMENTS*

During November, US utilities cancelled three nuclear units—Virginia Electric & Power Company's North Anna Unit 3 and Duke Power Company's Cherokee Units 2 and 3. Those cancellations had long been expected, however, so they will have no significant impact on forecasts of uranium demand or prices.

Cincinnati Gas & Electric (CG&E) suffered a more serious setback when the NRC ordered the utility to stop all safety-related work on the Zimmer unit. The project had been plagued with problems, but with construction nearly complete, the unit had been expected to enter commercial operations by 1984. In order to meet the NRC conditions for lifting the stop-work order, CG&E has begun negotiations to hire Bechtel as co-manager of the project. This latest development could very well delay the unit's commercial operating date by a year or more. Each year of delay represents a loss of uranium consumption of approximately 250-300 thousand pounds $U_3O_8$.

* * *

The NRC issued three licenses during November:

1. To Southern California Edison, a fuel loading and low-power license for San Onofre Unit 3.
2. To Pennsylvania Power & Light, a full-power operating license for Susquehanna Unit 1, a 1,060 MWe BWR.
3. To South Carolina Electric & Gas, a full-power operating license for its Summer unit, a 900 MWe PWR. Operations will be limited to 50 percent power until Westinghouse has completed a retrofit to correct steam generator vibrations; that is scheduled to be finished by mid-1983.

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## URANIUM: The Market and Market Decisions

As we address the status of the nuclear power industry as it relates to the supply of uranium, we can identify a set of challenges that will require even closer cooperation between our respective government and business sectors.

The international uranium market has a few characteristics which differentiate it from other commodities. First, there is only one commercial use of uranium. Secondly, the market participants (the producers and the users) are relatively small in number and easily identifiable. Thirdly, the supply and demand sectors of the market have different time constants. These three aspects of the uranium market often make the dynamics of supply and demand more strongly and readily felt. At the same time, because there are only a few transactions taking place (usually less than ten per month), the market lacks the stabilizing influence that would characterize the market if a large number of transactions took place each month.

During the 1960s and 1970s, expected high electrical load growth in many nations led to a large number of nuclear plant orders. These future uranium users were anxious to contract for their anticipated uranium requirements. There was concern that there might not be sufficient uranium available in the earth's crust. The price per pound of uranium in 1973 was $6.00, and by 1978 the price had increased to over $43.00 per pound $U_3O_8$.

The uranium price rise and the forecast demand spurred exploration and development activity, leading to the discovery of large, relatively high-grade uranium deposits in Canada, Australia and Central Africa. It soon became apparent that the availability of uranium would not be crucial in the competition between nuclear and fossil fired plants.

However, the anticipated uranium consumption fell short of projections. Many electric utilities incurred ten- to fifteen-year delays in nuclear power plant construction. As a result, today's large uranium inventories began accumulating.

Reduced load growth underlay decisions to delay and even cancel nuclear power plants. For many years, United States electric utilities had planned generating facilities based on a forecast of an approximate 7 percent annual load-growth increase. An annual increase in demand of about 3 percent has proven to be closer to reality. In contrast, TAIPOWER has experienced a much higher load growth in the recent past and a corresponding recent decline to near zero. Expectations are that it will again increase as the current worldwide recession eases.

No new nuclear power plants have been ordered in the US since 1978. During the past 7 years, over 60 nuclear power plant cancellations, representing approximately 60,000 MWe, have been announced. Several times that number have been substantially delayed, with many still indefinitely deferred.

In July of this year, TAIPOWER announced the government's decision to defer indefinitely the construction of planned nuclear units 7 and 8. The deferral was attributed to lowered forecasts of electric power demand. Even France, which has perhaps the most ambitious nuclear program in the world, has slowed their future program.

Thus, Free World uranium consumption is constantly falling short of the levels anticipated several years ago. However, most utilities are committed to purchasing uranium under long-term contracts and, as a result, are holding large inventories of $U_3O_8$, natural $UF_6$ and enriched $UF_6$. Free World electric utility inventories and national stockpiles now amount to about 5.5 years of forward consumption. This inventory position compares to a Free World desired inventory of about 2.5 to 3 years of forward consumption. Based on Nuexco projections, the Free World inventory balance will not improve for quite some time.

Demand can't be stimulated quickly; neither is it likely that supply will be reduced quickly. The inertia in the uranium industry combined with the start-up of new low-cost production centers means that much more uranium will be produced than will be consumed over the next several years, even though some of the higher cost producers will cease production.

The consumption picture cannot be expected to improve in the near future. Consumption can be reduced quickly as a result of cancellations and deferrals, but consumption increases have a long lead time due to the approximate ten-year regulatory and construction period for new nuclear plants.

As would be expected, the price of uranium has dropped substantially over the last few years. Uranium spot prices have declined by more than 40 percent in the last twenty-four months.

Over the past several years, the price decline has been accentuated by the inventories which have been offered for sale by inventory holders. Utility sales from inventory accounted for about 40 percent of 1981 spot and

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near-term uranium sales. Offers to sell by utilities averaged about 50 percent of all market offerings in the last six months of 1981.

For the past two years, the presence of this inventory on the spot and near-term market has contributed to the imbalance in uranium supply and demand and the market's general instability. During the first six months of 1982, the ratio of near-term supply to demand moved from approximately two-to-one to approximately sixteen-to-one. Supply and demand have become more balanced recently, because some sellers are retreating from aggressive sales positions. The inventory has not gone away and the fact that the inventory sellers may re-emerge at any time keeps the market in a state of unstable equilibrium.

Not only is inventory in the form of $U_3O_8$ being offered for sale, but utilities have been able to change already enriched and converted material into the more salable form of $U_3O_8$. This is done by means of creative transactions which allow a utility to sell the enrichment or conversion component of their uranium so that they are left with the simpler form of $U_3O_8$ to resell into the near-term market. When sold, a pound of 3% enriched material displaces about 14 pounds of $U_3O_8$ demand. A continuation of these "de-conversions" and "de-enrichments" will maintain the downward pressure on the spot market price.

The price trend of the past few years raises questions with respect to future market action and timing for the uranium user. There are mainly three types of forces at work in procurement decisions: economic, financial and political.

1. *Economic forces* are reflected in the price of uranium. The crucial question to a uranium buyer is one of timing: If one waits to contract for uranium, will the price go down; or, should one purchase now?

2. *Financial forces* are based upon the buyer's financial picture: The buyer will be very sensitive to the price of the uranium, the interest carrying charge, and the financial condition of his company.

The primary duty of the utility company—namely, to provide reliable service—dictates a strategy of risk avoidance. Risk avoidance translates into a desire to purchase uranium at market price, at the appropriate time. In this way, the utility avoids public criticism for paying more than the prevailing price at the time of delivery.

3. *Political and legal forces* are usually not under the control of the purchasing entity. A utility must operate within the regulations and guidelines determined by its government entity.

It is typical within the uranium industry to be very concerned with the economics of the industry. However, it is simply a partial consideration in the decision-making process. The financial, political and legal considerations are at least as important as the economic factors.

Security of supply considerations are evident at some point in all procurement decisions. Some nations, because of their political position, are more sensitive to supply assurance than others. These buyers will be expected to be less price sensitive in order to compensate for increased security of uranium supply.

The economic, financial and political factors are all tied into the decision to procure uranium and each will be given a different degree of importance by different purchasers. The decision to buy involves the condition of the market at any one time, the financial condition of the buyer and the perceived reliability of the supplier. Thus, it is not surprising that uranium contracting is often a long decision-making process and that the varying considerations are only infrequently determined to be favorably aligned.

From my point of view (that of a Broker), I judge that the market is approaching a bottom of the price cycle and will remain low for some time into the future. Thus, in this period of relative price stability, greater consideration could be directed toward the financial, political and legal questions.

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## FORECAST OF URANIUM PRODUCTION

### Introduction

This Report presents Nuexco's latest forecasts of uranium production for the world outside Communist areas (WOCA). Those forecasts are quantified in Tables 3, 4 and 5. Table 3 summarizes Nuexco's forecast of US production of $U_3O_8$ for centers operating or planned as of September 30, 1982. Table 4 shows Nuexco's forecast of world $U_3O_8$ production by region; Table 5 contains the same production estimates segmented according to status of the production center.

Production centers are divided into categories, according to stage of development, as follows:

1. Operating production centers—those which have shipped $U_3O_8$ in commercial quantities on or before September 30, 1982.
2. Production centers under construction—those which were being built as of September 30, 1982, and which have an established access to ore reserves. Conventional production centers are included in this category only if mill construction has actually begun.
3. Planned production centers—those for which firm development and construction commitments had been made as of September 30, 1982, and which Nuexco believes will be economically viable based on Nuexco's most recent price forecast.

### United States

The forecast detailed in Table 3 calls for US production of $U_3O_8$ this year to fall between 25 and 26 million pounds $U_3O_8$, a *one-third decline* since 1981. Furthermore, the forecast calls for a decline of fully 43 percent next year, so that forecast 1983 production is only 14.7 million pounds $U_3O_8$. That level is barely one-third the 1980 peak of almost 43 million pounds $U_3O_8$. Beyond 1983, the forecast calls for the US to maintain an annual production rate of approximately 12-13 million pounds $U_3O_8$ through 1990, before rising by 30 to 40 percent in 1991.

Nuexco's previous forecast called for US production rates to decline gradually to 13 million pounds by 1991. The substantial downward revision detailed in Table 3 is a direct result of US producers' dramatic reactions to the sustained price decline of the past four years. Declining ore grades, depletion of orebodies and high costs all played a part, but it is the reduced market prices which have forced so many US producers out of production. Other factors important to the forecast are:

1. Nuexco's belief that US utilities will not be willing to subsidize high-cost US producers by paying a substantial premium for US-origin $U_3O_8$.
2. Nuexco's belief that the US government will not erect barriers to the importation of large quantities of uranium, up to two-thirds of annual *unfilled* requirements of US utilities. A proposed US uranium import embargo has just been rejected by the House of Representatives, primarily because of vigorous opposition by the Reagan administration.

**Table 3**

**US URANIUM PRODUCTION FORECAST**
**(millions of pounds $U_3O_8$)**

| | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 |
|---|---|---|---|---|---|---|---|---|---|---|
| Operating | | | | | | | | | | |
| Conventional Mills | 17.6 | 9.0 | 7.2 | 8.4 | 7.2 | 7.2 | 7.6 | 7.6 | 7.8 | 8.9 |
| Unconventional Sources | 6.3 | 5.7 | 4.8 | 4.0 | 4.6 | 3.8 | 3.8 | 4.0 | 3.6 | 4.0 |
| Subtotal | 23.9 | 14.7 | 12.0 | 12.4 | 11.8 | 11.0 | 11.4 | 11.6 | 11.4 | 12.9 |
| Planned (as of September 30, 1982) | 0 | 0 | 0 | 0 | 0.5 | 1.0 | 1.0 | 1.0 | 2.0 | 4.0 |
| Shut Down 1982 (as of September 30, 1982) | 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTAL | 25.9 | 14.7 | 12.0 | 12.4 | 12.3 | 12.0 | 12.4 | 12.6 | 13.4 | 16.9 |

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## Table 4

## WORLD URANIUM PRODUCTION FORECAST[1]
(millions of pounds $U_3O_8$)

| | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 |
|---|---|---|---|---|---|---|---|---|---|---|
| Australia | 13.1 | 11.3 | 12.3 | 12.3 | 13.3 | 11.2 | 10.0 | 10.0 | 10.0 | 12.0 |
| Canada | 18.5 | 19.7 | 24.5 | 25.3 | 28.6 | 30.0 | 31.0 | 31.0 | 30.8 | 30.8 |
| Central Africa[2] | 11.7 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 |
| France | 5.9 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 |
| Namibia | 10.5 | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 |
| Republic of South Africa | 15.6 | 16.7 | 17.2 | 16.8 | 16.8 | 17.2 | 17.2 | 17.1 | 17.1 | 17.5 |
| Other Nations[3] | 2.0 | 3.0 | 3.0 | 3.6 | 4.4 | 4.4 | 4.2 | 3.9 | 3.9 | 3.5 |
| Non-US Total | 77.3 | 75.7 | 82.0 | 83.0 | 88.1 | 87.8 | 87.4 | 87.0 | 86.8 | 88.8 |
| US[4] | 25.9 | 14.7 | 12.0 | 12.4 | 12.3 | 12.0 | 12.4 | 12.6 | 13.4 | 16.9 |
| TOTAL (rounded) | 103 | 90 | 94 | 95 | 100 | 100 | 100 | 100 | 100 | 106 |

[1] Outside Communist areas

[2] Niger and Gabon

[3] Argentina, Belgium, Brazil, Chile, Mexico, Portugal, Spain and others

[4] This report, Table 3

## Table 5

## WORLD URANIUM PRODUCTION FORECAST[1]
(millions of pounds $U_3O_8$)

| | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 |
|---|---|---|---|---|---|---|---|---|---|---|
| Operating | | | | | | | | | | |
| US[2] | 25.9 | 14.7 | 12.0 | 12.4 | 11.8 | 11.0 | 11.4 | 11.6 | 11.4 | 12.9 |
| Non-US | 76.6 | 72.5 | 73.1 | 73.4 | 74.8 | 74.5 | 73.2 | 73.2 | 73.0 | 75.7 |
| Subtotal | 102.5 | 87.2 | 85.1 | 85.8 | 86.6 | 85.5 | 84.6 | 84.8 | 84.4 | 88.6 |
| Under Construction | | | | | | | | | | |
| US | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Non-US | 0.7 | 3.2 | 8.9 | 9.6 | 13.3 | 13.3 | 14.2 | 13.8 | 13.8 | 13.1 |
| Subtotal | 0.7 | 3.2 | 8.9 | 9.6 | 13.3 | 13.3 | 14.2 | 13.8 | 13.8 | 13.1 |
| Planned | | | | | | | | | | |
| US | 0 | 0 | 0 | 0 | 0.5 | 1.0 | 1.0 | 1.0 | 2.0 | 4.0 |
| Non-US | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Subtotal | 0 | 0 | 0 | 0 | 0.5 | 1.0 | 1.0 | 1.0 | 2.0 | 4.0 |
| TOTAL (rounded)[3] | 103 | 90 | 94 | 95 | 100 | 100 | 100 | 100 | 100 | 106 |

[1] Outside Communist areas

[2] Includes facilities shut down during 1982

[3] Any inconsistencies between this table and Table 3 are due to rounding.

## WOCA

The forecast detailed in Table 4 calls for WOCA uranium production to total approximately 103 million pounds in 1982, down somewhat from the 1981 level of approximately 112 million pounds $U_3O_8$. The forecast calls for the total to decline sharply in 1983, to 90 million pounds $U_3O_8$, and then to maintain a pattern of approximately 100 million pounds $U_3O_8$ per year (within 5 percent) for the remainder of the ten-year forecast period. At approximately 12-13 million pounds per year through 1990, US production will represent only about *one-eighth* of the WOCA total.

The reasons behind Nuexco's forecast of declining US production, briefly discussed in this article, have been detailed in previous Reports. However, the reasons for other producers' ability to maintain production under the same market conditions bear repeating. The reasons include:

1. Most producers in the rest of the world have long-term contracts calling for negotiated prices, so the continuing decline in spot market prices has affected them more slowly and to a lesser extent than in the US.

2. Outside the US, these effects were for a time limited to a few commercial producers of uranium, as opposed to captive producers. That trend is changing, but the nature of captive relationships is that the seller and buyer have various common interests. Thus, price negotiations with a captive producer are seldom truly arms-length, so the commercial producers would feel the effects of price declines first and strongest.

3. Some older non-US production facilities can be expected to phase out due to the same pressures of high cost and low grade which affect US producers, but the resulting decreases in production will be more than offset by new production from high-grade reserves in Canada and Australia.

4. Production arising from facilities captive to aggressive national nuclear power programs will also help to offset the forecast decline in US production. Active promotion of nuclear power by the governments of several nations allows them to use longer planning horizons than their US counterparts. Additionally, much of the important production outside the US is dedicated to attaining and sustaining national self-sufficiency in the nuclear fuel cycle, at least in nuclear raw materials. For these reasons, much of what might otherwise be excess or economically marginal uranium production outside the US will continue in operation.

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## COST OF ENRICHED URANIUM (US $ per KgU as $UF_6$, 3 percent $U_{235}$) FOR VARIOUS COMBINATIONS OF FEED AND SWU COSTS (0.20% TA)

| Feed Cost (US $ per KgU as Natural $UF_6$) | SWU Price (US $ per SWU) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 90 | 95 | 100 | 105 | 110 | 115 | 120 | 125 | 130 |
| 40 | 606.75 | 628.29 | 649.82 | 671.35 | 692.88 | 714.42 | 735.95 | 757.48 | 779.01 |
| 45 | 634.15 | 655.68 | 677.22 | 698.75 | 720.28 | 741.81 | 763.35 | 784.88 | 806.41 |
| 50 | 661.55 | 683.08 | 704.61 | 726.15 | 747.68 | 769.21 | 790.74 | 812.28 | 833.81 |
| 55 | 688.95 | 710.48 | 732.01 | 753.54 | 775.08 | 796.61 | 818.14 | 839.67 | 861.20 |
| 60 | 716.34 | 737.88 | 759.41 | 780.94 | 802.47 | 824.01 | 845.54 | 867.07 | 888.60 |
| 65 | 743.74 | 765.27 | 786.81 | 808.34 | 829.87 | 851.40 | 872.93 | 894.47 | 916.00 |
| 70 | 771.14 | 792.67 | 814.20 | 835.73 | 857.27 | 878.80 | 900.33 | 921.86 | 943.40 |
| 75 | 798.53 | 820.07 | 841.60 | 863.13 | 884.66 | 906.20 | 927.73 | 949.26 | 970.79 |
| 80 | 825.93 | 847.46 | 869.00 | 890.53 | 912.06 | 933.59 | 955.13 | 976.66 | 998.19 |
| 85 | 853.33 | 874.86 | 896.39 | 917.93 | 939.46 | 960.99 | 982.52 | 1,004.06 | 1,025.59 |
| 90 | 880.73 | 902.26 | 923.79 | 945.32 | 966.86 | 988.39 | 1,009.92 | 1,031.45 | 1,052.99 |
| 95 | 908.12 | 929.66 | 951.19 | 972.72 | 994.25 | 1,015.79 | 1,037.32 | 1,058.85 | 1,080.38 |
| 100 | 935.52 | 957.05 | 978.59 | 1,000.12 | 1,021.65 | 1,043.18 | 1,064.72 | 1,086.25 | 1,107.78 |
| | 90 | 95 | 100 | 105 | 110 | 115 | 120 | 125 | 130 |
| 105 | 962.92 | 984.45 | 1,005.98 | 1,027.52 | 1,049.05 | 1,070.58 | 1,092.11 | 1,113.65 | 1,135.18 |
| 110 | 990.32 | 1,011.85 | 1,033.38 | 1,054.91 | 1,076.45 | 1,097.98 | 1,119.51 | 1,141.04 | 1,162.57 |
| 115 | 1,017.71 | 1,039.25 | 1,060.78 | 1,082.31 | 1,103.84 | 1,125.37 | 1,146.91 | 1,168.44 | 1,189.97 |
| 120 | 1,045.11 | 1,066.64 | 1,088.18 | 1,109.71 | 1,131.24 | 1,152.77 | 1,174.30 | 1,195.84 | 1,217.37 |
| 125 | 1,072.51 | 1,094.04 | 1,115.57 | 1,137.10 | 1,158.64 | 1,180.17 | 1,201.70 | 1,223.23 | 1,244.77 |
| 130 | 1,099.90 | 1,121.44 | 1,142.97 | 1,164.50 | 1,186.03 | 1,207.57 | 1,229.10 | 1,250.63 | 1,272.16 |
| 135 | 1,127.30 | 1,148.83 | 1,170.37 | 1,191.90 | 1,213.43 | 1,234.96 | 1,256.50 | 1,278.03 | 1,299.56 |
| 140 | 1,154.70 | 1,176.23 | 1,197.76 | 1,219.30 | 1,240.83 | 1,262.36 | 1,283.89 | 1,305.43 | 1,326.96 |
| 145 | 1,182.10 | 1,203.63 | 1,225.16 | 1,246.69 | 1,268.23 | 1,289.76 | 1,311.29 | 1,332.82 | 1,354.36 |
| 150 | 1,209.49 | 1,231.03 | 1,252.56 | 1,274.09 | 1,295.62 | 1,317.16 | 1,338.69 | 1,360.22 | 1,381.75 |
| 155 | 1,236.89 | 1,258.42 | 1,279.96 | 1,301.49 | 1,323.02 | 1,344.55 | 1,366.09 | 1,387.62 | 1,409.15 |
| 160 | 1,264.29 | 1,285.82 | 1,307.35 | 1,328.89 | 1,350.42 | 1,371.95 | 1,393.48 | 1,415.02 | 1,436.55 |

## OPTIMUM TAILS ASSAY FOR VARIOUS COMBINATIONS OF FEED AND SWU COSTS (percent $U_{235}$)

| Feed Cost (US$ per KgU as Natural $UF_6$) | SWU Price (US $ per SWU) | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 90 | 95 | 100 | 105 | 110 | 115 | 120 | 125 | 130 | 138.65 | 140 | 149.85 | 160 | 170 | 180 | 190 | 200 |
| 40 | .316 | .322 | .327 | .333 | .338 | .343 | .347 | .352 | .356 | .363 | .364 | .372 | .379 | .385 | .391 | .397 | .402 |
| 45 | .302 | .308 | .314 | .320 | .325 | .330 | .334 | .339 | .343 | .350 | .351 | .359 | .366 | .373 | .379 | .384 | .390 |
| 50 | .291 | .297 | .302 | .308 | .313 | .318 | .323 | .327 | .332 | .339 | .340 | .347 | .354 | .361 | .367 | .373 | .379 |
| 55 | .280 | .286 | .292 | .297 | .302 | .307 | .312 | .317 | .321 | .328 | .329 | .337 | .344 | .351 | .357 | .363 | .368 |
| 60 | .271 | .277 | .282 | .288 | .293 | .298 | .302 | .307 | .311 | .319 | .320 | .327 | .334 | .341 | .347 | .353 | .359 |
| 65 | .262 | .268 | .273 | .279 | .284 | .289 | .294 | .298 | .302 | .310 | .311 | .318 | .326 | .332 | .339 | .345 | .350 |
| 70 | .254 | .260 | .265 | .271 | .276 | .281 | .285 | .290 | .294 | .301 | .302 | .310 | .317 | .324 | .330 | .336 | .342 |
| 75 | .246 | .252 | .258 | .263 | .268 | .273 | .278 | .282 | .287 | .294 | .295 | .302 | .310 | .316 | .323 | .329 | .334 |
| 80 | .239 | .245 | .251 | .256 | .261 | .266 | .271 | .275 | .279 | .287 | .288 | .295 | .302 | .309 | .316 | .322 | .327 |
| 85 | .233 | .239 | .244 | .249 | .254 | .259 | .264 | .268 | .273 | .280 | .281 | .288 | .296 | .302 | .309 | .315 | .321 |
| 90 | .227 | .232 | .238 | .243 | .248 | .253 | .258 | .262 | .266 | .274 | .275 | .282 | .289 | .296 | .302 | .308 | .314 |
| 95 | .221 | .227 | .232 | .237 | .242 | .247 | .252 | .256 | .260 | .268 | .269 | .276 | .283 | .290 | .296 | .302 | .308 |
| 100 | .216 | .221 | .227 | .232 | .237 | .242 | .246 | .251 | .255 | .262 | .263 | .270 | .278 | .284 | .291 | .297 | .302 |

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## COST OF ENRICHED URANIUM (US $ per KgU as $UF_6$, 3 percent $U_{235}$) FOR VARIOUS COMBINATIONS OF FEED AND SWU COSTS (0.20% TA)

| Feed Cost (US $ per KgU as Natural $UF_6$) | SWU Price (US $ per SWU) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 138.65 | 140 | 149.85 | 160 | 170 | 180 | 190 | 200 |
| 40 | 816.26 | 822.08 | 864.50 | 908.21 | 951.27 | 994.34 | 1,037.40 | 1,080.47 |
| 45 | 843.66 | 849.48 | 891.89 | 935.60 | 978.67 | 1,021.73 | 1,064.80 | 1,107.86 |
| 50 | 871.06 | 876.87 | 919.29 | 963.00 | 1,006.07 | 1,049.13 | 1,092.20 | 1,135.26 |
| 55 | 898.46 | 904.27 | 946.69 | 990.40 | 1,033.46 | 1,076.53 | 1,119.59 | 1,162.66 |
| 60 | 925.85 | 931.67 | 974.09 | 1,017.80 | 1,060.86 | 1,103.93 | 1,146.99 | 1,190.06 |
| 65 | 953.25 | 959.06 | 1,001.48 | 1,045.19 | 1,088.26 | 1,131.32 | 1,174.39 | 1,217.45 |
| 70 | 980.65 | 986.46 | 1,028.88 | 1,072.59 | 1,115.66 | 1,158.72 | 1,201.79 | 1,244.85 |
| 75 | 1,008.84 | 1,013.86 | 1,056.28 | 1,099.99 | 1,143.05 | 1,186.12 | 1,229.18 | 1,272.25 |
| 80 | 1,035.44 | 1,041.26 | 1,083.67 | 1,127.39 | 1,170.45 | 1,213.51 | 1,256.58 | 1,299.64 |
| 85 | 1,062.84 | 1,068.65 | 1,111.07 | 1,154.78 | 1,197.85 | 1,240.91 | 1,283.98 | 1,327.04 |
| 90 | 1,090.24 | 1,096.05 | 1,138.47 | 1,182.18 | 1,225.24 | 1,268.31 | 1,311.37 | 1,354.44 |
| 95 | 1,117.63 | 1,123.45 | 1,165.87 | 1,209.58 | 1,252.64 | 1,295.71 | 1,338.77 | 1,381.84 |
| 100 | 1,145.03 | 1,150.85 | 1,193.26 | 1,236.97 | 1,280.04 | 1,323.10 | 1,366.17 | 1,409.23 |
| 105 | 1,172.43 | 1,178.24 | 1,220.66 | 1,264.37 | 1,307.44 | 1,350.50 | 1,393.57 | 1,436.63 |
| 110 | 1,199.83 | 1,205.64 | 1,248.06 | 1,291.77 | 1,334.83 | 1,377.90 | 1,420.96 | 1,464.03 |
| 115 | 1,227.22 | 1,233.04 | 1,275.46 | 1,319.17 | 1,362.23 | 1,405.30 | 1,448.36 | 1,491.43 |
| 120 | 1,254.62 | 1,260.43 | 1,302.85 | 1,346.56 | 1,389.63 | 1,432.69 | 1,475.76 | 1,518.82 |
| 125 | 1,282.02 | 1,287.83 | 1,330.25 | 1,373.96 | 1,417.03 | 1,460.09 | 1,503.16 | 1,546.22 |
| 130 | 1,309.41 | 1,315.23 | 1,357.65 | 1,401.36 | 1,444.42 | 1,487.49 | 1,530.55 | 1,573.62 |
| 135 | 1,336.81 | 1,342.63 | 1,385.04 | 1,428.76 | 1,471.82 | 1,514.88 | 1,557.95 | 1,601.01 |
| 140 | 1,364.21 | 1,370.02 | 1,412.44 | 1,456.15 | 1,499.22 | 1,542.28 | 1,585.35 | 1,628.41 |
| 145 | 1,391.61 | 1,397.42 | 1,439.84 | 1,483.55 | 1,526.61 | 1,569.68 | 1,612.74 | 1,655.81 |
| 150 | 1,419.00 | 1,424.82 | 1,467.24 | 1,510.95 | 1,554.01 | 1,597.08 | 1,640.14 | 1,683.21 |
| 155 | 1,446.40 | 1,452.21 | 1,494.63 | 1,538.34 | 1,581.41 | 1,624.47 | 1,667.54 | 1,710.60 |
| 160 | 1,473.80 | 1,479.61 | 1,522.03 | 1,565.74 | 1,608.81 | 1,651.87 | 1,694.94 | 1,738.00 |

## OPTIMUM TAILS ASSAY FOR VARIOUS COMBINATIONS OF FEED AND SWU COSTS

(percent $U_{235}$)

| Feed Cost (US$ per KgU as Natural $UF_6$) | SWU Price (US $ per SWU) | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 90 | 95 | 100 | 105 | 110 | 115 | 120 | 125 | 130 | 138.65 | 140 | 149.85 | 160 | 170 | 180 | 190 | 200 |
| 105 | .211 | .216 | .222 | .227 | .232 | .236 | .241 | .245 | .250 | .257 | .258 | .265 | .272 | .279 | .285 | .291 | .297 |
| 110 | .206 | .211 | .217 | .222 | .227 | .231 | .236 | .240 | .245 | .252 | .253 | .260 | .267 | .274 | .280 | .286 | .292 |
| 115 | .201 | .207 | .212 | .217 | .222 | .227 | .231 | .236 | .240 | .247 | .248 | .255 | .262 | .269 | .275 | .281 | .287 |
| 120 | .197 | .202 | .208 | .213 | .218 | .222 | .227 | .231 | .235 | .242 | .243 | .250 | .258 | .264 | .271 | .277 | .282 |
| 125 | .193 | .198 | .204 | .209 | .213 | .218 | .222 | .227 | .231 | .238 | .239 | .246 | .253 | .260 | .266 | .272 | .278 |
| 130 | .189 | .194 | .200 | .205 | .209 | .214 | .218 | .223 | .227 | .234 | .235 | .242 | .249 | .256 | .262 | .268 | .273 |
| 135 | .185 | .191 | .196 | .201 | .205 | .210 | .214 | .219 | .223 | .230 | .231 | .238 | .245 | .251 | .258 | .264 | .269 |
| 140 | .182 | .187 | .192 | .197 | .202 | .206 | .211 | .215 | .219 | .226 | .227 | .234 | .241 | .247 | .254 | .260 | .265 |
| 145 | .178 | .184 | .189 | .194 | .198 | .203 | .207 | .211 | .215 | .222 | .223 | .230 | .237 | .244 | .250 | .256 | .261 |
| 150 | .175 | .180 | .185 | .190 | .195 | .199 | .204 | .208 | .212 | .218 | .219 | .227 | .234 | .240 | .246 | .252 | .258 |
| 155 | .172 | .177 | .182 | .187 | .192 | .196 | .200 | .204 | .208 | .215 | .216 | .223 | .230 | .237 | .243 | .248 | .254 |
| 160 | .169 | .174 | .179 | .184 | .188 | .193 | .197 | .201 | .205 | .212 | .213 | .220 | .227 | .233 | .239 | .245 | .251 |

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*RAW MATERIALS*

## THE SWANSON OREBODY

### Introduction

In July of this year, Marline Uranium Corporation announced the discovery of a significant uranium deposit six miles northeast of Chatham in Pittsylvania County, Virginia. A preliminary study indicates that this deposit, named the Swanson Orebody, contains about 30,000,000 pounds of $U_3O_8$ in ore reserves where average grade exceeds four pounds per ton. The study also identified large quantities of lower grade ore.

Marline was initially attracted to the southeastern United States by Precambrian geology along the Appalachian Piedmont. After initial field reconnaissance surveys in the summer of 1977, exploration efforts were concentrated in the vicinity of the northeast-southwest trending Triassic Basin. Additional surveys were conducted before leasing started in the fall of 1978 along the western boundary of the Danville Triassic Basin. The radiometric anomaly representing the Swanson deposit was identified in March 1979 during an airborne scintillometer survey on land already leased by Marline. Ore grade samples were collected from weathered outcrop in a ditch at the discovery site. Shortly thereafter the magnitude of the radiation anomaly was outlined as a result of detailed ground and airborne radiometric surveys. Defining the ore reserves of the Swanson deposit required the drilling of holes totaling over 124,000 feet. Figure 1 shows the location of the Swanson uranium deposit with relation to the Triassic geology.

### Setting

The area of the Swanson Deposit is typical of the Virginia Piedmont characterized by rounded hills with local relief usually less than 150 feet. The climate is mild and annual rainfall averages about 43 inches, evenly distributed throughout the year. Average temperature ranges from about 5 degrees C in January to 25 degrees C in July, with extremes ranging from -18 degrees C to 40 degrees C.

Land use is largely agriculture and timber with a population of approximately 23 persons per square mile. The main crops are tobacco, corn, soybeans, and hay. Livestock is largely limited to beef and dairy cattle.

### Surface Exploration Methods

Early exploration by Marline was primarily reconnaissance in nature. Autoborne surveys along public roads were made using Scintrix GIS-3 gamma-ray spectrometers, and Scintrex GBS-1 and McPhar TC-33 scintillometers mounted inside cars. Limited stream sediment, soil and soil radon measurements were made using an INAX-531 radon counter. These early efforts were successful in locating a number of radiometric anomalies along the western edge of the Danville Triassic Basin.

In central Virginia almost all rural land is privately owned. Access to land for any significant ground surveys requires leasing the mineral rights for exploration and mining. In 1978, Marline started leasing land in central Pittsylvania County, Virginia. Marline presently has exploration and mining leases on approximately 53,000 acres scattered along the Danville Triassic Basin.

With some land leased and the knowledge that significant mineralization was present, Marline did extensive airborne surveys in 1979. These surveys were done using a Bell 206-B Jet Ranger Helicopter carrying an Exploranium/GeoMetrics GR-800A four-channel differential gamma ray spectrometer with a sensor crystal volume of 1024 cubic inches. In addition, a Totem 1A VLF electromagnetic detector, manufactured by Hertz Industries, was mounted in a 20-pound bird towed 30 feet below the helicopter. The main terrain clearance was 175 feet and survey lines were one-quarter mile apart. The radiometric portion of the airborne survey worked very well, but the VLF data was virtually useless because of cultural interference such as power lines, fences and pipelines.

On the ground, detailed radiometric surveys over the Swanson Deposit were made using a four-channel gamma ray spectrometer (GeoMetric GR-310). Survey lines were one hundred feet apart and readings were taken at 20 foot intervals. Geochemical analysis of soil samples from reading stations were utilized to support the results of radiometric surveys. Uranium mineralization covered by barren rock and soil was not detected by the radiometric surveys.

A number of instruments have been used for ground geophysical surveys over the Swanson deposit. The best geophysical response was achieved using a PPM-300 field magnitometer synchronized to a PPM-400 digital base station magnitometer, both manufactured by EDS Instruments. The survey lines were 200 feet apart with readings taken at 50 foot intervals. This survey was supplemented by a gravity survey along selected lines using a La Costa-Romberg instrument. Radiation readings were taken at all magnitometer reading sites using a Urtec UG-130 gamma ray scintillometer.

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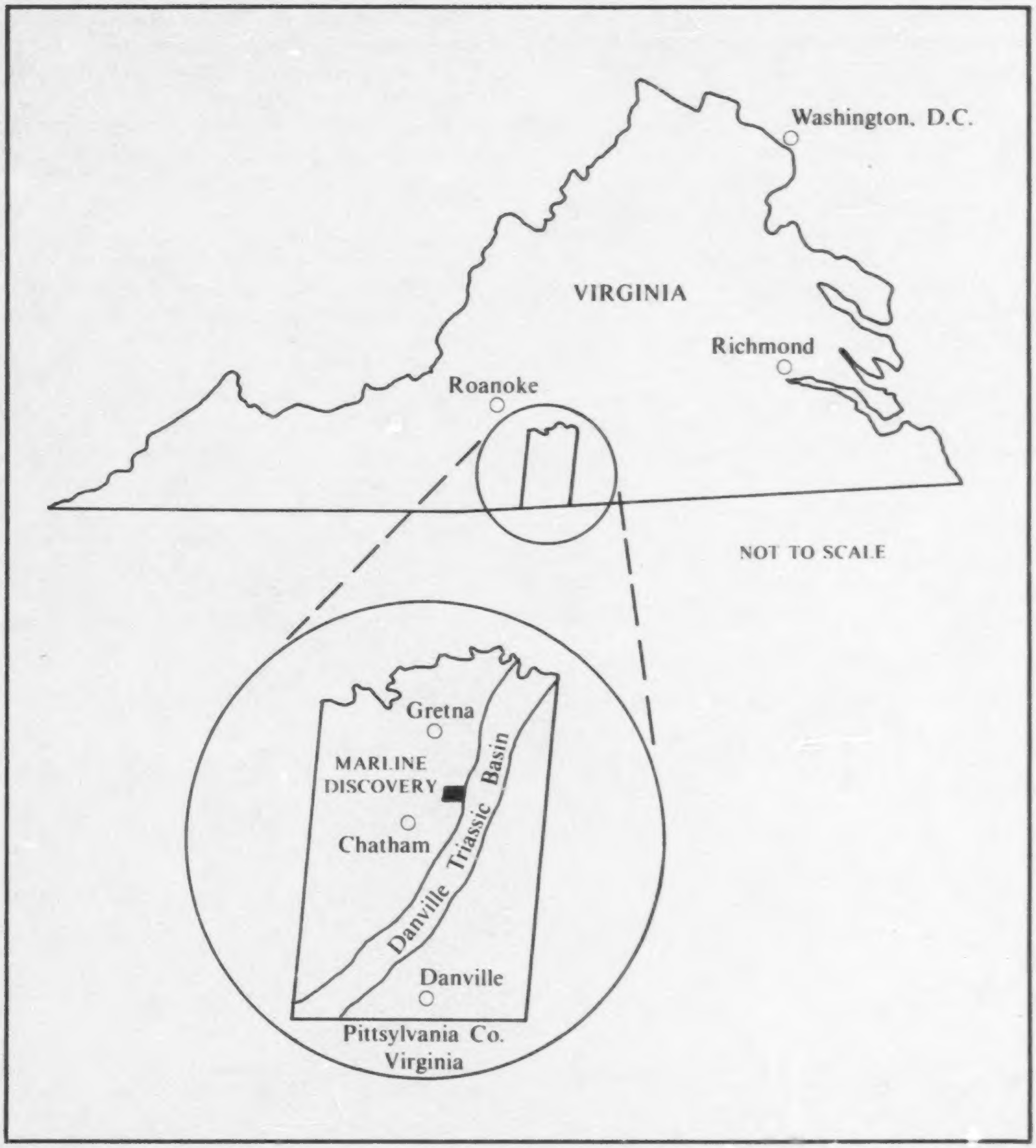
Washington, D.C.
VIRGINIA
Richmond
Roanoke
NOT TO SCALE
Gretna
MARLINE
DISCOVERY
Chatham
Danville Triassic Basin
Danville
Pittsylvania Co.
Virginia

**Figure 1**

**LOCATION OF THE SWANSON URANIUM DEPOSIT, PITTSYLVANIA COUNTY, VA.**

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## Geology

Uranium mineralization is associated with a shear zone adjacent to a major regional structure referred to as the Chatham Fault. The fault forms the western boundary of the Danville Triassic Basin (Figure 2). The indurated cataclastics along the Chatham Fault are unmineralized, as are the downfaulted Triassic rocks immediately to the east. The rocks which almost exclusively host the uranium mineralization consist of augen gniess of the Fork Mountain Formation, which is determined to be Precambrian-Lower Paleozoic in age. Minor quantities of mineralization occur in the Leatherwood Granite of Ordovician age where the granite is adjacent to the main ore zone. Pitchblende is the principal uranium mineral present. Isotopic lead-lead age dates of pitchblende indicate the age of uranium mineralization at just over 400 million years.

Uranium mineralization is exposed at the surface as a result of extensive erosion; however, a major part of the orebody plunges under a mantle of barren Fork Mountain Formation in a south-southeasterly direction as shown in Figure 3. The extent of deep mineralization, to date, has not been determined, but drill hole information shows mineralization extending below 1000 feet.

Two major categories of uranium mineralization have been encountered to date:

1. Disseminated uranium minerals, primarily discrete crystals of pitchblende, dispersed within the granulated groundmass of the preferred host rocks.

2. Colloform and crystalline uranium oxide minerals implaced within narrow, but abundant, calcite/quartz bearing veins and fractures. These veins and fractures generally crosscut the zones of disseminated mineralization. Therefore, they apparently constitute a later stage of mineralization.

The orebody as shown in Figure 3 is somewhat tabular and up to 500 feet wide. Since it crops out at the surface, the initial mining will be by open pit methods with, perhaps, underground methods used later. Stripping ratios will be low. Other uranium reserves in the vicinity of the Swanson deposit will require additional evaluation to determine if they can be mined economically. At this point there has been no preproduction development beyond exploration. The land over the orebody is presently returned to farm crop production.

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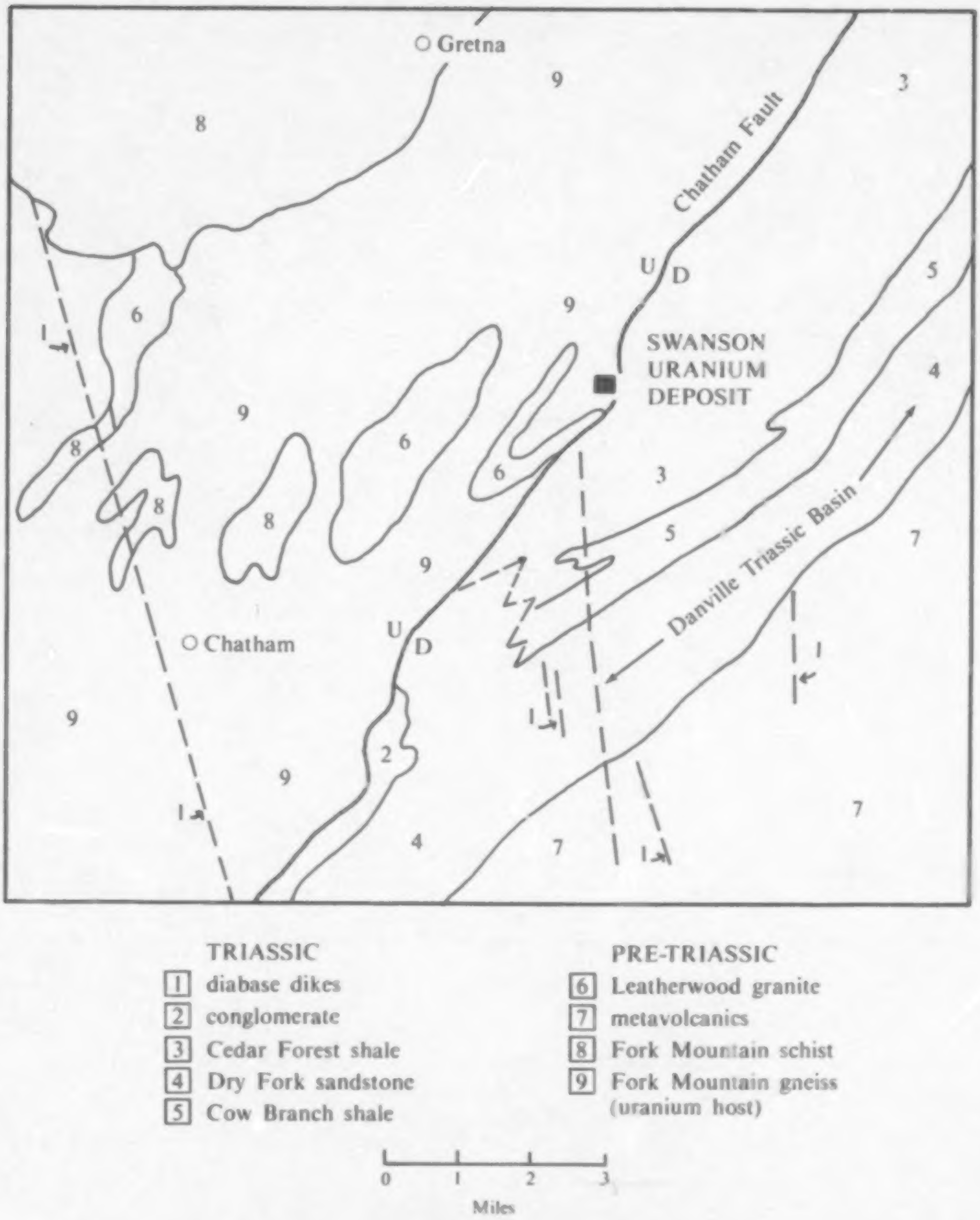
Gretna
Chatham Fault
U
D
SWANSON URANIUM DEPOSIT
Chatham
Danville Triassic Basin
1
2
3
4
5
6
7
8
9
TRIASSIC
1 diabase dikes
2 conglomerate
3 Cedar Forest shale
4 Dry Fork sandstone
5 Cow Branch shale
PRE-TRIASSIC
6 Leatherwood granite
7 metavolcanics
8 Fork Mountain schist
9 Fork Mountain gneiss (uranium host)
0
1
2
3
Miles

Figure 2

GEOLOGIC MAP
GENERAL VICINITY OF THE SWANSON URANIUM DEPOSIT

© NUEXCO 1982

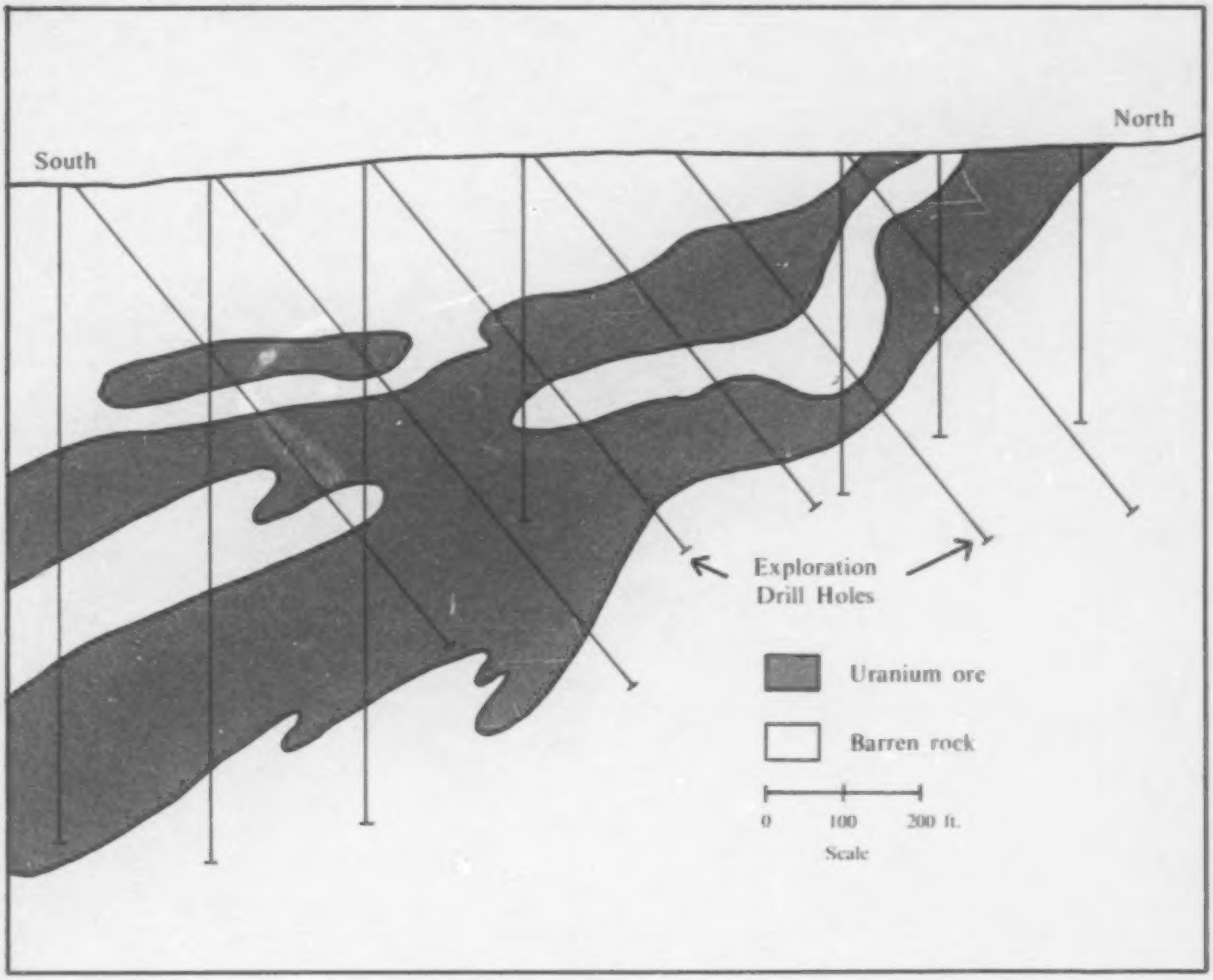
South
North
Exploration
Drill Holes
Uranium ore
Barren rock
0
100
200 ft.
Scale

**Figure 3**

**GENERALIZED NORTH-SOUTH CROSS-SECTION
THROUGH THE SWANSON URANIUM DEPOSIT**

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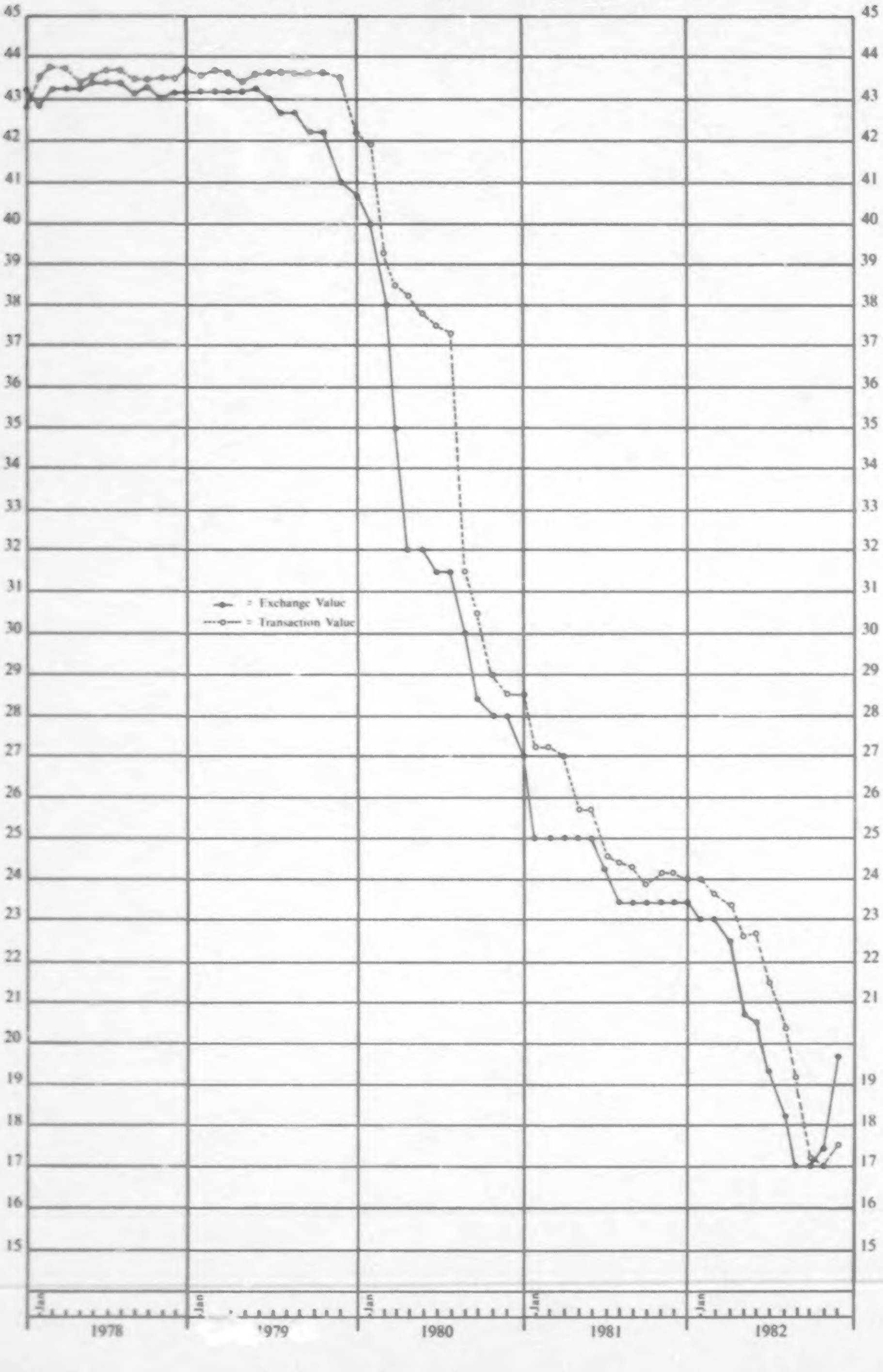
*HISTORICAL MARKET DATA*

## EXCHANGE AND TRANSACTION VALUES SINCE JANUARY 1978

Determined as of the last day of the month indicated



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## *HISTORICAL MARKET DATA*

### HISTORICAL EXCHANGE VALUES

Determined as of the last day of the month indicated (US Dollars/lb. $U_3O_8$)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1968 | — | — | — | — | — | — | — | 6.35 | 6.35 | 6.40 | 6.45 | 6.50 |
| 1969 | — | 6.35 | 6.10 | 6.10 | 6.25 | 6.25 | 6.20 | 6.20 | 6.15 | 6.15 | 6.15 | 6.20 |
| 1970 | 6.30 | 6.30 | 6.30 | 6.30 | 6.30 | 6.30 | 6.30 | 6.20 | 6.15 | 6.15 | 6.15 | 6.15 |
| 1971 | 6.20 | 6.20 | 6.20 | 6.20 | 6.15 | 6.05 | 6.00 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 |
| 1972 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 |
| 1973 | 5.95 | 6.00 | 6.10 | 6.20 | 6.45 | 6.50 | 6.50 | 6.50 | 6.50 | 6.50 | 6.75 | 7.00 |
| 1974 | 7.70 | 7.90 | 8.00 | 9.00 | 9.50 | 10.50 | 11.50 | 12.00 | 12.50 | 14.00 | 14.75 | 15.00 |
| 1975 | 16.00 | 16.00 | 18.00 | 20.00 | 21.00 | 23.00 | 24.70 | 26.00 | 26.00 | 28.50 | 30.00 | 35.00 |
| 1976 | 35.20 | 37.00 | 39.25 | 40.00 | 40.00 | 40.00 | 40.00 | 40.40 | 41.00 | 41.00 | 41.50 | 41.00 |
| 1977 | 41.35 | 41.50 | 41.60 | 41.60 | 42.00 | 42.25 | 42.25 | 42.25 | 42.40 | 42.75 | 43.20 | 43.20 |
| 1978 | 42.90 | 43.25 | 43.25 | 43.25 | 43.40 | 43.40 | 43.40 | 43.10 | 43.25 | 43.00 | 43.25 | 43.25 |
| 1979 | 43.25 | 43.25 | 43.25 | 43.25 | 43.25 | 43.00 | 42.70 | 42.70 | 42.20 | 42.20 | 41.00 | 40.75 |
| 1980 | 40.00 | 38.00 | 35.00 | 32.00 | 32.00 | 31.50 | 31.50 | 30.00 | 28.50 | 28.00 | 28.00 | 27.00 |
| 1981 | 25.00 | 25.00 | 25.00 | 25.00 | 25.00 | 24.25 | 23.50 | 23.50 | 23.50 | 23.50 | 23.50 | 23.50 |
| 1982 | 23.00 | 23.00 | 22.50 | 20.75 | 20.50 | 19.25 | 18.25 | 17.00 | 17.00 | 17.50 | **19.75** | |

### HISTORICAL TRANSACTION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. $U_3O_8$)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1976 | — | — | — | — | 39.60 | 39.70 | 39.70 | 40.40 | 40.30 | 40.60 | 40.70 | 40.70 |
| 1977 | 41.30 | 41.30 | 41.40 | 41.50 | 42.80 | 42.90 | 43.00 | 42.60 | 42.50 | 42.80 | 42.90 | 42.90 |
| 1978 | 43.10 | 43.30 | 43.70 | 43.60 | 43.60 | 43.20 | 43.30 | 43.40 | 43.40 | 43.60 | 43.40 | 43.70 |
| 1979 | 43.60 | 43.80 | 43.70 | 43.40 | 43.60 | 43.70 | 43.70 | 43.60 | 43.60 | 43.60 | 43.50 | 42.30 |
| 1980 | 42.00 | 39.30 | 38.60 | 38.40 | 37.90 | 37.60 | 37.30 | 31.60 | 30.60 | 29.00 | 28.70 | 27.70 |
| 1981 | 27.20 | 27.20 | 27.00 | 25.70 | 25.70 | 24.50 | 24.40 | 24.30 | 23.90 | 24.10 | 24.10 | 24.00 |
| 1982 | 24.00 | 23.70 | 23.40 | 22.60 | 22.70 | 21.50 | 20.30 | 19.10 | 17.30 | 17.00 | **17.55** | |

### EXCHANGE VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

| Country | per lb. $U_3O_8$ in Concentrates | per kg $U_3O_8$ in Concentrates | per kg U in Concentrates |
|---|---|---|---|
| US (dollar) | 19.75 | 43.54 | 51.35 |
| France (franc) | 138.99 | 306.41 | 361.33 |
| FRG (mark) | 49.13 | 108.31 | 127.73 |
| Japan (yen) | 4,957 | 10,929 | 12,888 |
| Switzerland (franc) | 42.26 | 93.16 | 109.85 |
| UK (pound) | 12.27 | 27.04 | 31.89 |
| Australia (dollar) | 20.66 | 45.55 | 53.72 |
| Canada (dollar) | 24.55 | 54.13 | 63.83 |
| Niger, Gabon (CFA) | 6,954 | 15,331 | 18,079 |
| South Africa (rand) | 21.93 | 48.35 | 57.02 |
| Sweden (kroner) | 147.17 | 324.45 | 382.60 |

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[1] Calculated using currency exchange rates published in the Wall Street Journal on November 30, 1982.

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## AUSTRALIAN GOVERNMENT STATISTICS

| | Price Index of Materials Used in Manufacturing Industry—All Groups (Year 1968-69 = 100.0)[1] | Weighted Average Minimum Weekly Wage Rates—Adult Males Australia Mining and Quarrying (A$)[2] |
|---|---|---|
| Annual Avg. 1971[3] | 101.5 | 65.95 |
| Annual Avg. 1972[3] | 105.6 | 71.26 |
| Annual Avg. 1973[3] | 124.4 | 78.96 |
| Annual Avg. 1974[3] | 141.9 | 108.07 |
| Annual Avg. 1975[3] | 150.4 | 132.55 |
| Annual Avg. 1976[3] | 168.4 | 160.93 |
| Annual Avg. 1977[3] | 192.0 | 179.03 |
| Annual Avg. 1978[3] | 198.5 | 190.04 |
| Annual Avg. 1979 | 248.8 | 196.34 |
| Annual Avg. 1980 | 321.8 | 218.00 |
| Annual Avg. 1981 | 355.3 | 237.34 |
| Jun 1981 | 360.4 | 237.93 |
| Jul 1981 | 356.9 | 237.86 |
| Aug 1981 | 359.9 | 237.86 |
| Sep 1981 | 357.4 | 238.00 |
| Oct 1981 | 351.6 | 239.26 |
| Nov 1981 | 351.3 | 241.31 |
| Dec 1981 | 349.9 | 258.56 |
| Jan 1982 | 354.9 | 261.58 |
| Feb 1982 | 356.7 | 262.95 |
| Mar 1982 | 360.3 | 263.12 |
| Apr 1982 | 367.7 | 262.99 |
| May 1982 | 367.6 | 263.24 |
| Jun 1982 | 367.2 | 264.23R |
| Jul 1982 | 369.1 | 272.38R |
| Aug 1982 | 371.5P | 272.23 |
| Sep 1982 | 374.1P | — |

P = Preliminary R = Revised since last month

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[1] Australian Bureau of Statistics, Canberra: "Price Index of Materials Used in Manufacturing Industry" (Catalogue No. 6411.0), Table 3.

[2] Australian Bureau of Statistics, Canberra: "Wage Rates, Australia" (Catalogue No. 6312.0), Table 1. Figures for the latest fourteen months shown are subject to revision.

[3] Monthly data for 1970 through 1978 appear on pages 4.7 and 4.8 of Nuexco Report 138.

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*GOVERNMENT STATISTICS*

## CANADIAN GOVERNMENT STATISTICS

| | Industry Selling Price Index: Manufacturing (D 500000)[1] [2] (1971 = 100.0) | Wage-earner Data: Average Hourly Earnings (C$)[3] [4] | | |
|---|---|---|---|---|
| | | **Metal Mining, including Milling (SIC 050-059)** | **Primary Metal Industries, non-ferrous (SIC 296-298)** | **Chemicals and Chemical Products (SIC 370-379)** |
| Annual Avg. 1978 | 190.4 | 8.76 | 6.82 | 6.97 |
| Annual Avg. 1979 | 217.9 | 9.60 | 7.35 | 7.67 |
| Annual Avg. 1980 | 247.2 | 10.59 | 8.05 | 8.50 |
| Annual Avg. 1981 | 272.3P | 12.02 | 9.03 | 9.53 |
| Sep 1981 | 276.9 | 12.47 | 9.22 | 9.77 |
| Oct 1981 | 279.3 | 12.78 | 9.35 | 9.91 |
| Nov 1981 | 278.8 | 12.89 | 9.45 | 9.89 |
| Dec 1981 | 280.0 | 12.87 | 9.42 | 10.03 |
| Jan 1982 | 281.9 | 13.14 | 9.53 | 10.11 |
| Feb 1982 | 283.5 | 13.25 | 9.60 | 10.19 |
| Mar 1982 | 284.8R | 13.34 | 9.62 | 10.35 |
| Apr 1982 | 287.6R | 13.46 | 9.79 | 10.48 |
| May 1982 | 289.0R | 13.56 | 9.88 | 10.62 |
| Jun 1982 | 290.0R | 13.71P | 9.92P | 10.69P |
| Jul 1982 | 290.7R | 13.67P | 10.05R | 10.72R |
| Aug 1982 | 290.5R | 13.50P | 10.31P | 10.77P |
| Sep 1982 | 292.4 | — | — | — |

P = Preliminary R = Revised since last month

[1] Statistics Canada, Prices Division, Ottawa; "Industry Price Indexes" (Catalogue 62-011), Table 1. Indexes for the most recent six months shown are subject to revision.

[2] Monthly data for 1973 through 1978 appear on page 4.10 of Nuexco Report 138.

[3] Statistics Canada, Labour Division, Employment and Payrolls Section, Ottawa; "Employment, Earnings and Hours" (Catalogue 72-002), Table 2.

[4] Monthly data for 1977 and 1978 appear on page 4.11 of Nuexco Report 138.

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## REPUBLIC OF SOUTH AFRICA STATISTICS

| | Average Declared Working Costs per Metric Ton of Gold Ore Milled (Rand)[1] | Consumer Price Index[2] (1975 = 100, except where otherwise indicated) | Producer[5] Price Index All Groups (1975 = 100) | Total Employment in Mining and Quarrying (Code 35)[7] | Total Salaries and Wages in Mining and Quarrying (1,000 Rand) (Code 40)[7] |
|---|---|---|---|---|---|
| Annual Avg. 1971[3] | 7.88 | 106.4[4] | 59.1 | 652,294 | 415,956 |
| Annual Avg. 1972[3] | 8.79 | 113.3[4] | 63.9 | 623,067 | 443,933 |
| Annual Avg. 1973[3] | 10.51 | 124.1[4] | 72.3 | 684,743 | 572,133 |
| Annual Avg. 1974[3] | 13.18 | 138.5[4] | 85.3 | 674,140 | 761,596 |
| Annual Avg. 1975[3] | 16.71 | 157.2[4] | 100.0 | 639,473 | 1,003,617 |
| Annual Avg. 1976[3] | 19.30 | 174.7[4] | 115.1 | 671,240 | 1,212,983 |
| Annual Avg. 1977[3] [6] | 23.87 | 194.4[4] | 130.0 | 712,006 | 1,420,670 |
| Annual Avg. 1978[3] [6] | 27.14 | 137.2 | 142.7 | 664,571 | 1,537,169 |
| Annual Avg. 1979[3] [6] | 30.18 | 155.3 | 164.5 | 692,209 | 1,830,632 |
| Annual Avg. 1980[6] | 35.53 | 176.7 | 192.1 | 714,379 | 2,279,615 |
| Annual Avg. 1981 | 41.89 | 206.5R | 218.3 | 728,506 | 2,820,505 |
| May 1981 | — | 197.7 | 213.2 | 726,869 | 219,880 |
| Jun 1981 | 40.41 | 200.0 | 215.3 | 728,506 | 237,049 |
| Jul 1981 | — | 204.6 | 218.4 | 735,839 | 249,080 |
| Aug 1981 | — | 208.0 | 222.6 | 722,684 | 245,817 |
| Sep 1981 | 43.28 | 211.6 | 224.6 | 724.604 | 251,502 |
| Oct 1981 | — | 213.4 | 227.0 | 717,918 | 248,159 |
| Nov 1981 | — | 214.8 | 229.4 | 720,255 | 253,044 |
| Dec 1981 | 44.52 | 216.3 | 230.4 | 709,612 | 257,655 |
| Jan 1982 | — | 217.6 | 233.1 | 700,375 | 257,173 |
| Feb 1982 | — | 220.2 | 236.8 | 705,992 | 250,191 |
| Mar 1982 | 45.49 | 225.2 | 237.4 | 725,700 | 262,210 |
| Apr 1982 | — | 228.9 | 241.9 | 707,502 | 252,562 |
| May 1982 | — | 230.3 | 244.8 | 715,162 | 258,770 |
| Jun 1982 | 45.77 | 232.1 | 246.7 | 707,552 | 261,361 |
| Jul 1982 | — | 234.1 | 249.4 | 702,141 | 283,248 |
| Aug 1982 | — | 236.8 | 253.4 | 705,562 | 276,730 |
| Sep 1982 | 48.04 | 241.0 | 255.0 | 704,490 | 276,730 |
| Oct 1982 | — | 243.9 | 260.1 | — | 281,331 |

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[1] Chamber of Mines of South Africa, Johannesburg; "Analysis of Working Results," published quarterly.
[2] Republic of South Africa Department of Statistics, Pretoria; "Government Gazette: Consumer Price Index for Urban Areas."
[3] Historical data for the Average Declared Working Costs and Consumer Price Index 1970-1979 appear on page 4.9 of Nuexco Report 140.
[4] April 1970 = 100.00.
[5] Previously known as the WHOLESALE PRICE INDEX, now the PRODUCER PRICE INDEX. The computation remains the same.
[6] Historical data for Codes 35 and 40 1977-1980 appear on page 28 of Nuexco Report 157.
[7] Bulletin of Statistics, Department of Statistics, Pretoria.

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## GOVERNMENT STATISTICS

### US GOVERNMENT STATISTICS

|  | Producer Price Index— Industrial Commodities (1967 = 100)[1] | Producer Price Index— All Commodities (1967 = 100)[1] | Consumer Price Index (1967 = 100)[2] | GNP Implicit Price Deflator (1972 = 100)[3] | Gross Average Hourly Earnings of Production or Non-supervisory Workers (US$)[4] |  |  |  |
|---|---|---|---|---|---|---|---|---|
|  |  |  |  |  | Metal Mining (SIC 10) | Primary Non-ferrous Metals (SIC 333) | Chemicals and Allied Products (SIC 28) | Electric and Electronic Equipment (SIC 36) |
| Annual Avg. 1971[5] | 114.1 | 114.0 | 121.3 | 96.01 | 4.12 | 4.15 | 3.97 | 3.49 |
| Annual Avg. 1972[5] | 117.9 | 119.1 | 125.3 | 100.00 | 4.56 | 4.59 | 4.26 | 3.71 |
| Annual Avg. 1973[5] | 125.9 | 134.7 | 133.1 | 105.75 | 4.84 | 4.98 | 4.51 | 3.91 |
| Annual Avg. 1974[5] | 153.8 | 160.1 | 147.7 | 115.08 | 5.44 | 5.63 | 4.88 | 4.21 |
| Annual Avg. 1975[5] | 171.5 | 174.9 | 161.2 | 125.79 | 6.13 | 6.24 | 5.39 | 4.64 |
| Annual Avg. 1976[5] | 182.4 | 183.0 | 170.5 | 132.34 | 6.76 | 6.87 | 5.91 | 4.96 |
| Annual Avg. 1977[5] | 195.1 | 194.2 | 181.5 | 140.05 | 7.28 | 7.67 | 6.43 | 5.39 |
| Annual Avg. 1978[5] | 209.4 | 209.3 | 195.4 | 150.42 | 8.23 | 8.56 | 7.02 | 5.82 |
| Annual Avg. 1979[5] | 236.5 | 235.6 | 217.4 | 163.42 | 9.27 | 9.50 | 7.60 | 6.32 |
| Annual Avg. 1980[5] | 274.8 | 268.8 | 246.8 | 178.64 | 10.26 | 10.63 | 8.30 | 6.94 |
| Annual Avg. 1981 | 304.1 | 293.4 | 272.4 | 195.51 | 11.55 | 11.98 | 9.12 | 7.62 |
| Oct 1981 | 309.0 | 296.1 | 279.9 | — | 12.08 | 12.44 | 9.37 | 7.80 |
| Nov 1981 | 309.3 | 295.5 | 280.7 | — | 12.12 | 12.48 | 9.42 | 7.83 |
| Dec 1981 | 310.0 | 295.8 | 281.5 | 201.55 | 12.08 | 12.45 | 9.53 | 7.90 |
| Jan 1982 | 311.7 | 298.2 | 282.5 | — | 12.19 | 12.66 | 9.68 | 7.98 |
| Feb 1982 | 311.4 | 298.5 | 283.4 | — | 12.22 | 12.61 | 9.68 | 7.96 |
| Mar 1982 | 311.0 | 298.0 | 283.1 | 203.68 | 12.29 | 12.69 | 9.71 | 8.01 |
| Apr 1982 | 309.9 | 298.0 | 284.3 | — | 12.23 | 12.68 | 9.81 | 8.03 |
| May 1982 | 309.6 | 298.6 | 287.1 | — | 12.25 | 12.71 | 9.83 | 8.05 |
| Jun 1982 | 310.6R | 299.3R | 290.6 | 205.98 | 12.26 | 12.91 | 9.95 | 8.09 |
| Jul 1982 | 313.0P | 300.6P | 292.2 | — | 12.23 | 12.91 | 10.02 | 8.18 |
| Aug 1982 | 313.4P | 300.4P | 292.8 | — | 12.29R | 12.97 | 10.03R | 8.24 |
| Sep 1982 | 312.9P | 299.5P | 293.3 | 208.38R | 12.39P | 13.43P | 10.21R | 8.32P |
| Oct 1982 | 314.4P | 299.9P | 294.1 | — | — | — | 10.26P | 8.36P |

P = Preliminary R = Revised since last month

[1] US Bureau of Labor Statistics, Washington, D.C.; "Producer Prices and Price Indexes," Table 6 (formerly "Wholesale Prices and Price Indexes"). Producer Price Indexes are revised four months after they are first released to reflect the availability of late reports and corrections by respondents.

[2] US Bureau of Labor Statistics, Washington, D.C.; Consumer Price Index for All Urban Consumers, US City Average, All Items.

[3] US Department of Commerce, Washington, D.C.; Bureau of Economic Analysis, National Income and Wealth Division; "Survey of Current Business," Table A. The GNP Implicit Price Deflator is published quarterly, and seasonally adjusted.

[4] US Bureau of Labor Statistics, Washington, D.C.; "Employment and Earnings," Table C-2. All data based on 1972 revision of SIC Manual. Data for 1970-1976 are adjusted to the March 1977 benchmark. Data for 1977-1978 are adjusted to the March 1979 benchmark. Data for January 1979 and beyond are adjusted to the March 1980 benchmark.

[5] Monthly data 1970-1978 for Producer Price Index-Industrial Commodities, Consumer Price Index, and Employment and Earnings SIC codes 10, 333, and 28, and quarterly data for GNP Implicit Price Deflator appear on pages 4.6-4.8 of Nuexco Report 139.
Monthly data 1977-1978 for Employment and Earnings SIC Codes 10, 333, and 28 appear on page 33 of Nuexco Report 147.
Monthly data 1970-1978 for Employment and Earnings SIC Code 36 appear on page 23 of Nuexco Report 154.
Monthly data 1979-1980 for Employment and Earnings, Revised Establishment Data, all listed codes, appear on page 22 of Nuexco Report 158.
Monthly data 1977-1980 for Producer Price Index-All Commodities, appear on page 21 of Nuexco Report 158.

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NUEXCO

JANUARY 1983 NUMBER 173

# Monthly Report on the Nuclear Fuel Market

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# NUEXCO REPORT 173
## EXECUTIVE SUMMARY

**1982 Annual Review: Part 1 of 2**

Part 1 of Nuexco's **Annual Review** features a discussion of price behavior in 1982 for natural uranium and conversion. Also, important developments in Canada and the United States are reviewed. Next month, Part 2 will feature a review of secondary SWU market developments in 1982. It will also review important market developments that took place in Africa, Australia, Europe and the Far East.

**Exchange Value Rose $0.50, to $20.25**

The **Exchange Value** as of December 31, 1982 is **$20.25** per pound $U_3O_8$. Nine uranium sales are reported, involving more than 17 million pounds $U_3O_8$ equivalent. Five long-term transactions accounted for 87% of the total.

**Near-term Supply-Demand Ratio is 2.3:1**

*Active* sellers in the zero to one year time frame are offering 8.8 million pounds $U_3O_8$, up 70% from 5.2 million pounds last month. After spot and near-term transactions representing more than two million pounds were concluded during December, *active uranium demand* dropped to 3.9 million pounds $U_3O_8$ as of the end of the month, a 25% decline since last month. Therefore, the supply-demand ratio increased to 2.3:1.

**Transaction Value Jumped $1.25, to $18.80**

The **Transaction Value** as of December 31, 1982 is **$18.80** per pound $U_3O_8$. It includes 17 transactions totaling 5.7 million pounds $U_3O_8$ and covers a period of three months.

**Conversion Value Unchanged at $1.45**

The **Conversion Value** as of December 31, 1982 is **$1.45** per pound U as $UF_6$, unchanged from last month. One conversion transaction is reported. Active sellers are offering 2.6 million pounds U as $UF_6$ in near-term conversion services, down slightly since last month. Active demand fell to 220 thousand pounds U as $UF_6$, one-fifth last month's level. The decrease was due to the departure of one potential buyer for a large quantity.

**Loan Use Charge Rate Steady at 6%**

The **Loan Use Charge Rate** as of December 31, 1982 is **6 percent** per annum. One transaction is reported.

**Enriched Uranium and SWUs**

Although a number of 3.5-year DOE Requirements contract holders are seeking secondary market supplies for FY 1983, Nuexco is not presently aware of any sellers willing to offer prices low enough to make contract terminations attractive. The prevailing discount for DOE FY 1983 SWU remains at approximately $25. Sellers of DOE SWU for delivery in FY 84 continue to offer discounts of $28-$30 from DOE's AFC price (at .2 tails). The market for DOE SWU for FY 1985 and later has virtually disappeared while potential sellers await DOE's announcement of the terms and conditions of conversion to the FR contract.

**Analysis & Commentary**

Nuexco's latest forecast of Apparent Future Consumption indicates that the Free World is presently consuming uranium at the rate of approximately 70 million pounds $U_3O_8$ per year. That rate is forecast to reach 100 million pounds by 1987.

A supply-demand analysis based on Nuexco's latest forecasts indicates that the worldwide uranium industry is on the verge of achieving intermediate-term to long-term stability.

**Raw Materials**

Reviews US producer activities of 1982.

**1982 Index**

Will be printed next month.

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## NUEXCO REPORT 173
## FIGURES OF THE MONTH

| | This Month | Last Month | 12 Months Ago |
|---|---|---|---|
| | (Referenced to December 31, 1982) | | |
| Exchange Value[1] | 20.25 | 19.75 | 23.50 |
| Transaction Value[1] | 18.80 | 17.55 | 24.00 |
| Conversion Value[2] | 1.45 | 1.45 | 1.20 |
| Loan Use Charge Rate[3] | 6% | 6% | 6% |
| Near-Term Uranium Supply[4] | 8.8 | 5.2 | 8.8 |
| Near-Term Uranium Demand[5] | 3.9 | 5.2 | 4.3 |
| Near-Term Supply-Demand Ratio | 2.3 | 1.0 | 2.0 |
| Current Transactions[6]: | | | |
| Number of Transactions | 9 | 9 | 10 |
| Quantity of Material[7] | 8.7-22.4 | 6.1-12.1 | 2.3-4.9 |
| USDOE SWU Prices[8]: | | | |
| AFC | 138.65 | 138.65 | 130.75 |
| Requirements | 149.85 | 149.85 | 127.59 |
| Optimum Tails Assay[9] | .327 | .329 | .305 |
| Calculated Price of Enriched $UF_6$[10] [11]: | | | |
| 2.5 w/o $U_{235}$ | 698.99 | 693.19 | 709.04 |
| 3.0 w/o $U_{235}$ | 903.04 | 895.97 | 912.30 |
| 3.5 w/o $U_{235}$ | 1,111.24 | 1,102.91 | 1,119.48 |
| 4.0 w/o $U_{235}$ | 1,322.50 | 1,312.91 | 1,329.55 |

---

[1] US $ per pound $U_3O_8$ equivalent

[2] US $ per pound U as $UF_6$

[3] Per annum

[4] Active inquiries to sell, for delivery within 12 months after contract signing (millions of pounds $U_3O_8$)

[5] Active inquiries to purchase, for delivery within 12 months after contract signing (millions of pounds $U_3O_8$)

[6] Uranium transactions only; does not include loans, conversion, or SWU transactions

[7] Millions of pounds $U_3O_8$, equivalent

[8] US $ per SWU

[9] Percent $U_{235}$.

[10] Theoretical calculation based on Exchange Value, Conversion Value, 0.20 percent tails assay and the USDOE price for AFC SWUs.

[11] US $ per KgU as $UF_6$

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NUEXCO

# MONTHLY REPORT ON THE URANIUM MARKET

January 1983 No. 173

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R. WESLEY MILLER, *EDITOR*

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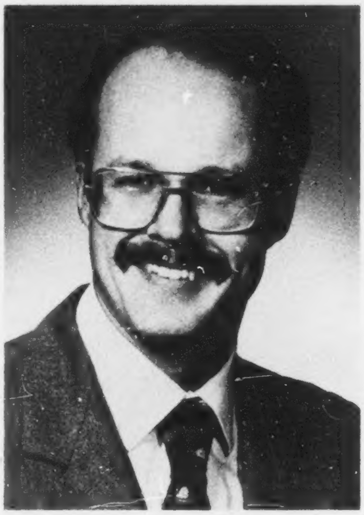
## *FOREWORD*

We are pleased to announce that **Mr. Donald W. Radcliffe** joined Nuexco this month as a Fuel Cycle Consultant. Don will assist Dick Andersen in expanding Nuexco's consulting activities.

Don was previously employed at General Electric in the Nuclear Energy Business Group, where he was a Senior Fuel Program Manager. Don has had many years of experience working with the electric utility industry in marketing nuclear fuel, developing fuel requirements, improving license procedures, introducing improved fuel designs and negotiating contracts. He holds a Bachelor of Science Degree in Engineering from the California Institute of Technology and a Masters Degree in Mechanical Engineering from the University of California at Berkeley.



On December 21, Nuexco's New York office moved to Stamford, Connecticut. The new address is:

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*Until the new telex is installed, customers may send telexes to **Ken McCue, Scott Hickman** and **Terry Lindsay** via our Menlo Park office. The number is: 470674 (NUEXCO UI).

* * *

The following report is now available from Nuexco: "Uranium: World Market Study and Price Forecast: 1982 to 1996." The study presents a detailed analysis of Uranium:

Consumption
Production
Inventories
Unfilled Requirements
Uncommitted Production
Production Costs
Spot Market Price Forecast

Five cases are analyzed for the period 1982 to 1996, including scenarios based on the effects of different international policies and political developments.

For further information, please contact Dick Andersen in our headquarters office.

## NATURAL URANIUM AND CONVERSION

### December 1982

The **Exchange Value** as of December 31, 1982 is **$20.25** per pound $U_3O_8$, up $0.50 since last month. Buying activity was once again quite vigorous; the *Current Market Data* section lists nine uranium sales transactions, involving more than 17 million pounds $U_3O_8$ equivalent. The five long-term transactions accounted for approximately 87 percent of that amount, while four spot or near-term transactions accounted for the balance.

* * *

**Active uranium supply** (material offered at competitive prices, terms and other conditions) amounts to **8.8 million pounds $U_3O_8$** equivalent in the near term, an increase of 3.6 million pounds over last month's level of 5.2 million. After spot and near-term transactions representing more than two million pounds $U_3O_8$ were concluded during the month of December, **active uranium demand** for spot or near-term delivery dropped to **3.9 million pounds $U_3O_8$** equivalent, a 25 percent decrease. Therefore, the **supply-demand ratio** increased to 2.3:1.

The **Transaction Value** as of December 31, 1982 is **$18.80** per pound $U_3O_8$, up $1.25 from a month ago. The current Transaction Value includes 17 transactions totaling 5.7 million pounds $U_3O_8$ and covers a period of three months. Because the Transaction Value is still being influenced by transactions reported in October, when prices were substantially lower, it still lags the current Exchange Value somewhat.

* * *

The **Conversion Value** as of December 31, 1982 is **$1.45** per pound U as $UF_6$, unchanged from last month. **Active offers to sell conversion services** in the near term amount to approximately **2.6 million pounds U as $UF_6$**, a ten percent decrease. **Active conversion demand** dropped to **220 thousand pounds U as $UF_6$**, one-fifth last month's level. All of the decrease was due to the exit of one potential buyer for a large quantity. One substantial conversion transaction is reported in the *Current Market Data* section.

* * *

The **Loan Use Charge Rate** remained at six percent per annum. The limited activity in the market is at or near that level, but there are very few participants. Although one loan transaction reported in the *Current Market Data* section occurred at approximately 6½ percent, there are still significant quantities of material available for loan at the level of the current Loan Use Charge Rate.

* * *

During December, an observable, but difficult to quantify, spread developed between the different transactions which took place and, even more so, between bids and offers. On the one hand, US producers seem to be demanding a premium, perhaps 5 percent, for *US-origin* uranium in the form of *concentrates*. On the other hand, buyers outside the US seem to be willing to accept any one of several origins and any one of several forms of uranium in order to obtain the best price. Complicating this situation is the fact that buyers who would prefer US-origin concentrates do not yet seem to be indicating a willingness to pay the premiums being demanded by US producers.

### 1982 Annual Review

### Summary

For the worldwide uranium market, 1982 brought an end, at least temporarily, to a price decline that had persisted for more than three years. In fact, the first eight months of the year saw the Exchange Value fall by $6.50, to a recent low of $17.00 on August 31 (and September 30), 1982. That constituted a 28 percent decline from its December 31, 1981 level of $23.50. By the end of the year, the Exchange Value had regained half of its loss, rebounding to $20.25, a level 14 percent below that of a year ago. Table 1 lists the Exchange Value for each month in 1982.

### The Price Decline

The Exchange Value ended 1981 at $23.50 per pound $U_3O_8$, having been at that level for six months. Prices appeared to have bottomed. However, renewed and aggressive selling developed as a result of several factors, including cancellations and delays of nuclear facilities, continued overproduction, growing inventories, high interest rates and litigation. The January 31, 1982 Exchange Value dropped to $23.00, setting in motion a sustained 28 percent decline, which saw the Exchange Value reach $17.00 by the end of August.

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## *PRICING*

### Table 1

### 1982 EXCHANGE VALUES, CONVERSION VALUES, AND LOAN USE CHARGE RATES

| Determined as of the Last Day of the Month Indicated | Report Number | Exchange Value[1] (per lb. $U_3O_8$) | Conversion Value[2] (per lb. $U_3O_8$) | Loan Use Charge Rate[3] (per annum) |
|---|---|---|---|---|
| January | 162 | $23.00 | $1.20 | 6% |
| February | 163 | $23.00 | $1.20 | 6% |
| March | 164 | $22.50 | $1.20 | 6% |
| April | 165 | $20.75 | $1.20 | 6% |
| May | 166 | $20.50 | $1.00 | 6% |
| June | 167 | $19.25 | $1.00 | 6% |
| July | 168 | $18.25 | $1.00 | 6% |
| August | 169 | $17.00 | $0.90 | 6% |
| September | 170 | $17.00 | $1.10 | 6% |
| October | 171 | $17.50 | $1.60 | 6% |
| November | 172 | $19.75 | $1.45 | 6% |
| December | 173 | $20.25 | $1.45 | 6% |

[1] Defined on page 8 of this Report. Historical data are reprinted in each Monthly Report.
[2] Defined on page 8 of this Report. Historical Conversion Values are tabulated in this Report, Table 5.
[3] Defined on page 9 of this Report. Historical Loan Use Charge Rates for 1968-1981 appeared in Report 162 on pages 32-34.

Several factors contributed to last January's resumption of the price decline.

1. Transactions had recently been concluded at lower price levels.
2. Lower prices were being negotiated in pending transactions.
3. Buyers and sellers perceived that recent cancellations and deferrals of reactors would make available for sale, in the near term, additional large quantities of inventory.
4. As expected, the amount of material available for sale in the near term did increase, peaking in July at nearly 18 million pounds $U_3O_8$ equivalent.

Aware of these developments and sensing a weakening market, buyers became increasingly selective, particularly in the spot and near-term markets. Some buyers who had been active in the market delayed their purchasing. At the same time, sellers trying to anticipate the trend entered the market with substantial quantities of material.

Table 2 lists the monthly uranium supply, demand and supply-demand ratios for 1982. Although those figures do not correspond directly to changes in Exchange Value, they can help somewhat to interpret the reasons behind spot or near-term price movements.

For the first six to nine months of 1982, the uranium market was characterized by the willingness of a few particularly aggressive sellers to cut prices as much as necessary to sell their material. At least eight different market participants, not all at the same time, each sold during 1982 more than 1,000,000 pounds $U_3O_8$ for spot or near-term delivery. Sellers included utilities and producers, as well as US and non-US entities. Those sales campaigns, which appear complete, were marked by aggressive pricing and led to sales of more than 11 million pounds $U_3O_8$. With that sort of pressure being exerted on the spot and near-term markets, it is not surprising that the Exchange Value declined to $17.00. However, by fall of 1982, the mood of the most active sellers in the market had become one of less urgency. Resisting buyers' efforts to extract lower prices, they were showing less willingness to reduce prices in the hope of stimulating demand.

### The Turnaround

After declining to $17.00 on August 31, the Exchange Value held steady until October 31, when it increased fifty cents to $17.50. That was the first increase since November 1978, four years earlier. The November 30 Exchange Value's increase of $2.25 marked the first time in *exactly five years* that the Exchange Value had increased in two consecutive months. The November 30

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### Table 2

### 1982 SPOT AND NEAR-TERM[1] URANIUM SUPPLY AND DEMAND
**(Active[2] Inquiries as Reported by Nuexco)**

| As of the Last Day of the Month | Report Number | Uranium Supply (Inquiries to Sell) | Uranium Demand (Inquiries to Purchase) | Supply-Demand Ratio | Exchange Value (per lb. $U_3O_8$) |
|---|---|---|---|---|---|
| | | (millions of pounds $U_3O_8$, equivalent) | | | |
| January | 162 | 10.1 | 4.0 | 2.5 | $23.00 |
| February | 163 | 10.9 | 3.3 | 3.3 | $23.00 |
| March | 164 | 11.2 | 2.2 | 5.2 | $22.50 |
| April | 165 | 13.0 | 1.4 | 9.3 | $20.75 |
| May | 166 | 15.2 | 1.6 | 9.5 | $20.50 |
| June | 167 | 17.8 | 1.1 | 16.2 | $19.25 |
| July | 168 | 2.6 | 1.0 | 2.6 | $18.25 |
| August | 169 | 1.7 | 0.16 | 10.6 | $17.00 |
| September | 170 | 3.3 | 0.66 | 5.0 | $17.00 |
| October | 171 | 4.3 | 2.1 | 2.1 | $17.50 |
| November | 172 | 5.2 | 5.2 | 1.0 | $19.75 |
| December | 173 | 8.8 | 3.9 | 2.3 | $20.25 |

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[1] For delivery within one year.

[2] Nuexco began describing Inquiries as either ACTIVE or INACTIVE with the publication of Report 164. Therefore, this Table includes *all* spot and near-term inquiries to buy or sell uranium which were published in Reports 162 and 163.

Exchange Value's increase of thirteen percent was also the second largest percentage increase in history, surpassed only by one of 17 percent on December 31, 1975. Finally, the Exchange Value rose fifty cents in December, to finish the year at $20.25, only 14 percent below the level of one year ago.

Among the many reasons for the sudden reversal of the US supply-demand situation, the most obvious is the subsidence of selling pressure which several inventory holders (both utilities and producers) had been putting on the market. Earlier in the year, more than half of the total available supply might have been offered by US inventory holders. As of the end of December, the single inventory seller is offering for sale just 500 thousand pounds $U_3O_8$. Several other factors contributed to the turnaround.

1. By the late summer or early fall of 1982, the most aggressive sellers had largely completed sales campaigns begun earlier in the year. In the same time frame, buyers began to exhibit renewed interest in purchasing under long-term contracts at the lowered price levels. That upsurge in demand caused a dramatic recovery in the active supply-demand ratio; from an imbalanced 16.2:1 in August, it dropped to an almost ideal 1:1 as of November 30. With sellers demanding higher prices, buyers suddenly began to find a more difficult market and, in turn, had to become more aggressive to complete desired transactions. The sellers also sensed the shifted market dynamics and moved their offering levels higher.

2. The initial increase in the Exchange Value (from $17.00 to $17.50 per pound $U_3O_8$ on October 31) was viewed by some buyers and sellers as a signal that spot prices had bottomed and were perhaps rebounding.

3. Expectations that the proposed US uranium import limitation would be enacted may have been a contributing factor.

4. The great majority—over 90 percent at one point—of buying was being done by utilities adding to inventory which, in some cases, will not be utilized until the late 1980s or later. Such behavior suggests that those buyers believed that purchases at the current spot market price plus carrying charges would prove to be less expensive than waiting to purchase nearer time of actual use in a reactor. Those buyers were indicating their judgments that uranium prices, in constant dollars, will rise substantially in the longer term. Such inventory purchases could be expected to continue (while cash remained available at relatively favorable terms) until the spot prices began to approach the present value of expected future prices.

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5. Nuexco first noted the trend toward utility purchases for inventory in Report 162—the same report that marked the resumption of the price decline as the January 31 Exchange Value dropped to $23.00—in which we noted that: ". . . prices in the spot and near-term markets are diverging from those of the intermediate and long-term markets. Utility invitations for five- to ten-year supplies (typically beginning in the 1983-1985 time period) are unlikely to evoke sales offers at prices related to current spot market levels. To the extent that the price differential exceeds inventory carrying costs, it is possible, as in the past, that some buyers may elect to buy and hold inventory as opposed to contracting longer term. Such early procurement would, of course, tend to strengthen spot prices."

**Outlook for 1983 and Beyond**

Because many producers and utilities wish it to be true, there is some speculation that a sustained price recovery is underway. However, it is Nuexco's opinion that to forecast a sustained price rise would be premature at this juncture.

The psychological aspects of spot price movements are substantial and predictions as to the duration and magnitude of any particular move are usually more intuitive than objective. Nevertheless, regardless of whether they turn out to be accurate, market perceptions can be self-fulfilling *in the short term.*

For example, the prospect of a US embargo on the import of non-US origin uranium may have contributed to the recent price rise by altering the perceptions of some market participants. Anticipating that US uranium imports would be limited somehow, sellers might have been encouraged to raise their asking prices and then to hold more firmly to them. Likewise anticipating an import limitation and concurrent price rises, some buyers may have pursued one or more market opportunities more vigorously and with lessened sensitivity to price.

On the other hand, the embargo issue and the past three months' price increases may have been more a coincidence of timing than cause and effect. The embargo issue first surfaced in early 1982 when the Exchange Value was well over $20.00 per pound $U_3O_8$. However, the House of Representatives' decisive defeat of the proposed US uranium import embargo could have the opposite effect.

Furthermore, much of the purchasing currently taking place is discretionary, and such demand could well vanish if prices continue to rise. Utilities willing to increase inventories at what they view as bargain prices will likely withdraw if prices rise substantially above current levels. Similarly, producers who are purchasing rather than producing can and will produce when the economics of their individual "make or buy" decisions change.

For the long term, however, it would be imprudent to ignore certain basic and very powerful market factors. The inventory redistribution so necessary for an optimum balance between supply and demand is far from complete. While some utilities and producers have liquidated excess stocks, others could become sellers at any time, particularly if utilities began to receive more pressure from their regulatory authorities to carry less uranium in inventory.

The basic production-consumption equation is out of balance and gives every indication of remaining so for several more years. Production continues at a rate of 100 million pounds $U_3O_8$ annually and is forecast to continue at that rate for the rest of this decade. Consumption, though rising, is still only about 60 million pounds annually and is forecast to remain below production for the next five years. It is difficult to develop a case for a strong price recovery under such conditions.

Thus, while current perceptions could lead to price recovery in the near term, market participants would be advised to bear in mind those market factors that have too often been ignored in the short history of the commercial uranium market. For the short term, those are:

1. Potential for non-US inventory selling;
2. US inventory selling;
3. Production exceeding consumption;
4. Nuclear plant construction delays;
5. Reduced concern for security of supply;
6. Production cutbacks;
7. Government regulations in supplier nations;
8. Operating plant needs.

Factors that appear more relevant for the longer term are:

1. Low electrical load growth;
2. New nuclear plant orders;
3. Rich non-US ore grades and timing of production from these deposits;
4. Non-US government price controls;
5. Sustained revenues for underdeveloped nation suppliers;
6. New high-grade discoveries;
7. Production levels affected by gold prices.

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## Table 3

## 1982 TRANSACTION VALUES[1]
(and Associated Parameters)

| Determined as of the Last Day of the Month Indicated | Report Number | Transaction Value (per lb. $U_3O_8$) | Millions of Pounds | Number of Transactions | Number of Months |
|---|---|---|---|---|---|
| January | 162 | 24.00 | 2.8 | 20 | 5 |
| February | 163 | 23.70 | 2.2 | 14 | 3 |
| March | 164 | 23.40 | 2.8 | 12 | 3 |
| April | 165 | 22.60 | 3.6 | 13 | 3 |
| May | 166 | 22.70 | 4.0 | 15 | 4 |
| June | 167 | 21.50 | 2.6 | 11 | 4 |
| July | 168 | 20.30 | 2.2 | 10 | 4 |
| August | 169 | 19.10 | 2.3 | 14 | 4 |
| September | 170 | 17.30 | 3.2 | 16 | 3 |
| October | 171 | 17.00 | 3.6 | 20 | 3 |
| November | 172 | 17.55 | 4.9 | 20 | 3 |
| December | 173 | 18.80 | 5.7 | 17 | 3 |

[1] Defined on page 8 of this Report. Historical Transaction Values and their associated parameters for the years 1976-1981 appeared in Report 161 on pages 31 and 32.

The **Transaction Value** lagged the Exchange Value throughout 1982. The December 31, 1981 Transaction Value of $24.00 was unchanged in the first month of this year. One month after the Exchange Value began its decline, the Transaction Value began to follow. The Transaction Value reached the same low point as the Exchange Value ($17.00), but only after the Exchange Value had been at that point for the two previous months. In fact, the Transaction Value's low point came at the same time the Exchange Value began its rise. The year ended with Transaction Value at $18.80 and rising, as transactions from earlier months, when prices were at or near their lows, are dropped out of the sample. Table 3 lists the Transaction Value and its associated parameters (which relate to sample size) for each month of 1982.

* * *

The **Conversion Value** began 1982 at $1.20 per pound U as $UF_6$ and held that level for four months. Then, as shown in Table 1, it dropped steadily until reaching a low of $0.90 in August. Then it rose to $1.60 and dropped back to $1.45 for the last two months of the year. Throughout the year, the secondary market for conversion services had few participants and only small quantities were traded. As a consequence, the Conversion Value was very volatile. In such a market, sometimes referred to as *thin* or *shallow*, the actions of one buyer or seller can have a disproportionate effect on prices. This factor applies to the secondary conversion market even more than it does to the uranium market. Table 4 lists spot and near-term conversion supply and demand for each month in 1982. Table 5 lists the Conversion Value for each of the 24 months that Nuexco has been publishing it.

* * *

The **Loan Use Charge Rate** remained at six percent per annum for every month in 1982. In general, there was very little activity and there were very few participants in the loan market. Table 4 lists loan supply and demand for each month in 1982.

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*PRICING*

### Table 4

## 1982 SPOT AND NEAR-TERM[1]
## CONVERSION AND LOAN SUPPLY AND DEMAND
### (Active[2] Inquiries as Reported by Nuexco)

| As of the Last Day of the Month | Report Number | Conversion Supply (millions of pounds U as $UF_6$) | Conversion Demand (millions of pounds U as $UF_6$) | Loan Supply (millions of pounds $U_3O_8$, equivalent) | Loan Demand (millions of pounds $U_3O_8$, equivalent) | Exchange Value (per pound $U_3O_8$) |
|---|---|---|---|---|---|---|
| January | 162 | 2.4 | 0.5 | 2.7 | 1.8 | $23.00 |
| February | 163 | 3.4 | 0.5 | 2.4 | 2.9 | $23.00 |
| March | 164 | 3.1 | 0.6 | 3.0 | 1.3 | $22.50 |
| April | 165 | 4.8 | 0.8 | 6.4 | 0.8 | $20.75 |
| May | 166 | 4.9 | 0.7 | 8.4 | 0.3 | $20.50 |
| June | 167 | 4.5 | 0.3 | 9.2 | 0.3 | $19.25 |
| July | 168 | 2.8 | 0.7 | 9.2 | 0.3 | $18.25 |
| August | 169 | 2.6 | 0.7 | 7.1 | 0.0 | $17.00 |
| September | 170 | 1.8 | 0.1 | 4.1 | 0.0 | $17.00 |
| October | 171 | 1.7 | 0.3 | 4.8 | 0.8 | $17.50 |
| November | 172 | 2.9 | 1.6 | 2.8 | 0.8 | $19.75 |
| December | 173 | 2.6 | 0.2 | 3.2 | 1.5 | $20.25 |

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[1] For delivery within one year

[2] Nuexco began describing Inquiries as either ACTIVE or INACTIVE with the publication of Report 164. Therefore, this Table includes *all* spot and near-term conversion or loan inquiries which were published in Reports 162 and 163.

### Table 5

## HISTORICAL CONVERSION VALUES[1]
### Determined as of the last day of the month indicated
### (US dollars per pound U as $UF_6$)

| 1981 | Report Number | Conversion Value | 1982 | Report Number | Conversion Value |
|---|---|---|---|---|---|
| January | 150 | 1.20 | January | 162 | 1.20 |
| February | 151 | 1.20 | February | 163 | 1.20 |
| March | 152 | 1.20 | March | 164 | 1.20 |
| April | 153 | 1.40 | April | 165 | 1.20 |
| May | 154 | 1.15 | May | 166 | 1.00 |
| June | 155 | 1.15 | June | 167 | 1.00 |
| July | 156 | 1.15 | July | 168 | 1.00 |
| August | 157 | 1.10 | August | 169 | 0.90 |
| September | 158 | 1.10 | September | 170 | 1.10 |
| October | 159 | 1.10 | October | 171 | 1.60 |
| November | 160 | 1.20 | November | 172 | 1.45 |
| December | 161 | 1.20 | December | 173 | 1.45 |

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[1] The Conversion Value is Nuexco's judgment of the price at which spot and/or near-term transactions for significant quantities of conversion services could be concluded in the secondary market as of the last day of the month.

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## ENRICHED URANIUM AND SWU

The short term secondary market remains active. A number of 3.5 year DOE requirements contract holders continue to seek secondary market supplies for FY 1983. These buyers are, in virtually all cases, utilities who have not yet terminated their requirements contracts, but who are seeking SWU priced low enough to allow them to terminate and purchase on the secondary market at a savings.

Nuexco is not presently aware of any sellers of DOE FY 1983 SWU willing to offer prices low enough to make such terminations economically attractive. The prevailing discount remains at approximately $25 per SWU from DOE's AFC price (at .2 tails). Those buyers may choose to purchase Eurodif SWU on the secondary market or retain their Requirements contracts. Nuexco is aware of two US utilities who decided last month to purchase Eurodif SWU for 1983 to replace Requirements contract deliveries.

Offers for DOE SWU in FY 1984 remain at about a $28-$30 discount from DOE's FY 1984 price, assuming a .2 tails assay. There remains a large surplus of DOE SWU available for FY 1984, and there have been few transactions recently. Some potential 1984 buyers, however, have indicated concern that the level of discounts offered may drop soon due to the introduction of the FR contract, so the level of activity in this market segment could increase in the near future.

The market for DOE SWU for FY 1985 and later has virtually disappeared while potential sellers await DOE's announcement of the terms and conditions of conversion to the FR contract. There are a number of secondary market sellers offering Eurodif SWU for long-term delivery at base escalated prices, but few transactions have actually taken place.

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*CURRENT MARKET DATA*

**EXCHANGE VALUE $20.25/lb. $U_3O_8$**
Determined as of December 31, 1982

**Definition**[1]

The Exchange Value is Nuexco's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the last day of the month.

**Derivation**

Nuexco bases the Exchange Value upon:

A. Data from recently completed transactions.
B. Data from pending transactions.
C. Firm bids to buy and firm offers to sell.
D. Prices purchasers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy, and prices sellers have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell.

**Comments**

Nuexco does not consider the following in determining the Exchange Value:

A. The price of uranium delivered or to be delivered under old contracts.
B. The price of uranium delivered in connection with contract renegotiations or other than arm's length transactions.

[1] In December, 1981, Nuexco published a history of the Exchange Value which chronicled, month-by-month, changes in its definition, usage and derivation. Copies are available upon request.

**TRANSACTION VALUE**[2]
Determined as of December 31, 1982

| $/lb. $U_3O_8$ | Millions of Pounds | Number of Transactions | Number of Months |
|---|---|---|---|
| 18.80 | 5.7 | 17 | 3 |

**Definition**

The Transaction Value is a weighted average price of recent transactions, and is based on prices paid for $U_3O_8$ in transactions closed within the previous three-month period and for which delivery was scheduled within one year of the transaction date. At least ten transactions totaling at least two million pounds $U_3O_8$ are included in each calculation, or the sample time is extended as necessary to include these minima. Foreign currencies are converted to US dollars as of the transaction date.

**Comments**

Nuexco does not consider the following in determining the Transaction Value:

A. The price of uranium delivered in connection with contract renegotiations or other than arm's length transactions.
B. The price of uranium delivered in connection with contracts which call for "market price" mechanisms. This exclusion applies particularly to contracts in which delivery prices are expressed as a function of Exchange Value or any other independent variable. Also excluded from consideration are all data where the delivery price is defined in such a way that it cannot currently be determined.

[2] Transaction Values for 1976 through 1981 and their associated parameters (millions of pounds, number of transactions and number of months) are tabulated on pages 31 and 32 of Report 161.

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*CURRENT MARKET DATA*

**CONVERSION VALUE $1.45/lb. U as $UF_6$**
Determined as of December 31, 1982

**Definition**

The Conversion Value is Nuexco's judgment of the price at which spot and/or near-term transactions for significant quantities of conversion services could be concluded in the secondary market as of the last day of the month.

**Derivation**

Nuexco bases the Conversion Value upon:

A. Data from recently completed transactions.
B. Data from pending transactions.
C. Firm bids to buy and firm offers to sell.
D. Prices purchasers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy, and prices sellers have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell.

**Comments**

Nuexco does not consider the following in determining the Conversion Value:

A. The price of conversion services delivered or to be delivered under old contracts.
B. The price of conversion services delivered in connection with contract renegotiations or other than arm's length transactions.

**LOAN USE CHARGE RATE[1] 6%**
Determined as of December 31, 1982

**Definition**

The Loan Use Charge Rate is Nuexco's judgment of the annual interest rate at which uranium loans could be concluded as of the last day of the month.

**Derivation**

Nuexco bases the Loan Use Charge Rate upon:

A. Data from recently completed or pending loan transactions.
B. Rates included in firm proposals to borrow or lend.
C. Rates that potential borrowers and lenders have expressed as a willingness to pay or accept, but for which Nuexco is not aware of firm proposals.

[1] Monthly data for 1968 through 1981 appear on pages 32-34 of Report 162.

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*CURRENT MARKET DATA*

## TRANSACTION SUMMARY[1]

### Uranium Transactions

| Nuexco Reference Number | Delivery Period | Approximate Quantity (thousands of pounds, $U_3O_8$ equivalent) | Approximate Price as Percent of Current E.V. | Seller | Buyer | Remarks |
|---|---|---|---|---|---|---|
| 2058 | 1985-90 | 1001-3000 | indeterminate | Canadian Producer | US Utility | Price related to market |
| 2059 | 1983-90 | 1001-3000 | indeterminate | Canadian Producer | European Utility | Price related to market |
| 2060 | 1983-90 | 1001-3000 | indeterminate | Canadian Producer | Canadian Utility | Price related to market |
| 2061 | 1983-90 | 3001-6000 | indeterminate | Canadian Producer | European Utility | Price related to market |
| 2062 | 1983 | 601-1000 | 99 | European Entity | European Entity | $UF_6$ |
| 2067 | 1983 | less than 50 | 103 | European Entity | Canadian Producer | |
| 2068 | 1984-93 | 1001-3000 | 150 | US Producer | US Utility | Base price plus escalation |
| 2090 | 1983 | 1001-3000 | 97 | European Entity | US Producer | $UF_6$ |
| 2102 | 1983 | 101-300 | 96 | Unknown | US Utility | $UF_6$ |

### Conversion Transactions

| Nuexco Reference Number | Delivery Period | Approximate Quantity (thousands of pounds, U equivalent) | Approximate Price as Percent of Current C.V. | Seller | Buyer | Remarks |
|---|---|---|---|---|---|---|
| 2097 | 1984 | 601-1000 | 100 or more | European Utility | European Utility | |

### Loan Transactions

| Nuexco Reference Number | Delivery Period | Approximate Quantity (thousands of pounds, $U_3O_8$ equivalent) | Approximate Price as Percent of Current L.U.C.R. | Lender | Borrower | Remarks |
|---|---|---|---|---|---|---|
| 2106 | unknown | 101-300 | 108 | US Utility | Canadian Producer | |

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[1] Transactions listed are not limited to those in which Nuexco was involved, but also include others of which Nuexco is aware.

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*CURRENT MARKET DATA*

## URANIUM SUPPLY
## (As of 12/31/82)

| Nuexco Reference Number | Delivery Period[1] (Thousands of Pounds $U_3O_8$) 0 to 1 Year | Beyond 1 Year | Remarks |
|---|---|---|---|
| **Available for Sale:** | | | |
| **ACTIVE** | | | |
| 1575 | | 500 per year | Long Term |
| 1581 | 100 | | |
| 1610 | 25 | | |
| 1818 | | 250 per year | Long Term |
| 1921 | 2,100 | | $UF_6$ |
| 1925 | 500 | | $UF_6$ |
| 2017 | | 2,300 | |
| 2020 | | 200 per year | 1983-92 |
| 2038 | 1,500 | | $UF_6$ |
| 2056 | 2,200 | | $UF_6$ |
| 2114 | 700 | | |
| 2126 | 500 | | $UF_6$ |
| 2158 | 500 | | $UF_6$ |
| 2203 | 700 | | |
| TOTAL: | 8,825 | | |
| **INACTIVE** | | | |
| 1804 | 615 | | |
| 1805 | | 500 per year | Long Term |
| 1877 | 100 | | |
| 1928 | 1,000 | | $UF_6$ |
| TOTAL: | 1,715 | | |

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[1] Measured from the date of this Report

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*CURRENT MARKET DATA*

## URANIUM DEMAND
### (As of 12/31/82)

| Nuexco Reference Number | Delivery Period[1] (Thousands of Pounds $U_3O_8$) | | Remarks |
|---|---|---|---|
| | 0 to 1 Year | Beyond 1 Year | |
| **Inquiries to Purchase:** | | | |
| **ACTIVE** | | | |
| 1652 | | 400 per year | Long Term |
| 1871 | | 250 per year | 1983-86 |
| 1995 | 250 | | |
| 1996 | | 400 | |
| 2000 | | 250 | |
| 2010 | | 400 per year | 1984-92 |
| 2014 | 160 | | |
| 2030 | | 1,350 | 1984-85 |
| 2042 | | 400 per year | Long Term |
| 2054 | 110 | | |
| 2059 | 2,200 | | |
| 2061 | 50 | | |
| 2105 | 600 | | $UF_6$ |
| 2123 | 500 | 500 per year | 1983-87 |
| TOTAL: | 3,870 | | |
| **INACTIVE** | | | |
| 1459 | | 200 per year | Long Term |
| 1843 | 250 | | |
| 1888 | | 400 per year | Long Term |
| 1963 | | 50 | |
| 1966 | 100 | 200 | |
| 1985 | 100 | | |
| 1999 | | 50 per year | 1985-90 |
| 2025 | | 350 | |
| 2032 | | 200 | |
| 2066 | | 200 | |
| 2114 | | 200 per year | 1984-90 |
| 2115 | | 200 per year | 1984-85, $UF_6$ |
| TOTAL: | 450 | | |

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[1] Measured from the date of this Report.

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*CURRENT MARKET DATA*

## CONVERSION SUPPLY
## (As of 12/31/82)

| Nuexco Reference Number | Delivery Period[1] (Thousands of Pounds U as UF6) 0 to 1 Year | Beyond 1 Year | Remarks |
|---|---|---|---|
| **ACTIVE** | | | |
| 1609 | 500 | 1,500 per year | Long Term |
| 1840 | 130 | | |
| 1902 | | 400 | |
| 1936 | 1,000 | 200 per year | Long Term |
| 2051 | 1,000 | | |
| TOTAL: | 2,630 | | |
| **INACTIVE** | | | |
| 1925 | 450 | | |
| 2008 | 800 | 800 | |
| TOTAL: | 1,250 | | |

## CONVERSION DEMAND
## (As of 12/31/82)

| Nuexco Reference Number | Delivery Period[1] (Thousands of Pounds U as UF6) 0 to 1 Year | Beyond 1 Year | Remarks |
|---|---|---|---|
| **ACTIVE** | | | |
| 1995 | 220 | | |
| 2148 | | 400 per year | 1984-86 |
| TOTAL: | 220 | | |
| **INACTIVE** | | | |
| 1594 | | 450 per year | Long Term |
| 1622 | | 400 | |
| TOTAL: | | | |

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[1] Measured from the date of this Report.

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*CURRENT MARKET DATA*

## LOAN SUPPLY AND DEMAND
## (As of 12/31/82)

| Nuexco Reference Number | Delivery Period[1] (Thousands of Pounds $U_3O_8$) 0 to 1 Year | Beyond 1 Year | Remarks |
|---|---|---|---|
| **Available for Loan:** | | | |
| **ACTIVE** | | | |
| 1938 | 2,000 | | |
| 2006A | 600 | | |
| 2157 | 600 | | |
| TOTAL: | 3,200 | | |
| **INACTIVE** | | | |
| 1815 | 1,000 | | $UF_6$ |
| 1884 | 600 | | |
| 1910 | 1,000 | | |
| 1931 | 600 | | |
| 2036 | 500 | | |
| 2040 | 500 | | $UF_6$ |
| 2133 | 200 | | |
| TOTAL: | 4,400 | | |
| **Inquiries to Borrow:** | | | |
| **ACTIVE** | | | |
| 1998 | 200 | 200 | |
| 2006 | 600 | | |
| 2070 | 200 | | $UF_6$ or $U_3O_8$ |
| 2125 | 500 | | $UF_6$ or $U_3O_8$ |
| TOTAL: | 1,500 | | |
| **INACTIVE** | None | | |

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[1] Measured from the date of this Report

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## AFRICA

**South Africa**'s Koeberg nuclear power station was sabotaged in late December. Officials of the Electricity Supply Commission of South Africa (Escom) had expected to receive authorization to load fuel shortly, but now commissioning will be delayed for an as yet undetermined time. Although some control rod components will have to be replaced, the damage done on the political front could prove more serious. The success of the attack has called into question the adequacy of the plant's security measures, already more stringent than those at other nuclear power stations. Delays for that cause could be much longer than those due to the physical damage. In spite of this setback, the Koeberg station should begin operations before the end of 1983.

## CANADA

### Summary

Once again during 1982, the uranium news in Canada centered around the province of Saskatchewan, even though most Canadian $U_3O_8$ is still being produced in Ontario. A preliminary tabulation of uranium *shipments* indicates that Canada's uranium production for 1982 will total approximately 21 million pounds $U_3O_8$. That figure includes 8 million pounds from western Canada and 13 million pounds from eastern Canada. Production from both areas will probably increase during 1983. The onset of production from Key Lake and from Rio Algom's Stanleigh mine will more than offset the mid-1982 shutdowns of Eldorado's Beaver Lodge operations at Uranium City and Madawaska Mines' Bancroft, Ontario mine and mill. Aside from projects already under development, exploration and development activity in Canada is generally declining, pending higher uranium prices.

### Major Commercial Events

Ontario Hydro deferred delivery of a portion of the Elliot Lake material covered by their long-term supply agreements with Denison and Rio Algom and purchased 13.5 million pounds of Key Lake material from Eldorado Nuclear and Uranerz Exploration and Mining Limited. This move will reduce Ontario Hydro's average annual $U_3O_8$ costs by substituting relatively low-cost uranium from Saskatchewan for some of their higher-cost uranium produced in Ontario.

* * *

Eldorado Nuclear announced the purchase of all the outstanding shares of Gulf Minerals Canada Limited in return for uranium concentrates from Eldorado's inventory (essentially all of the Canadian stockpile). The sale was concluded in October. As a result, Gulf Oil is no longer a uranium producer in Canada and Eldorado has acquired the Rabbit Lake mill and Gulf's share of the associated orebodies as well as the Collins Bay deposit. In a separate transaction, Eldorado acquired sole ownership in the Rabbit Lake mill by purchasing Uranerz Canada Limited's minority interest. Rabbit Lake is presently producing about three million pounds per year and output should increase to five million pounds per year by 1985 with the changeover to Collins Bay ore. Eldorado received approval for its environmental impact assessment for the Collins Bay "B" zone at the end of 1982.

* * *

Development of the Key Lake project continued throughout 1982 and initial production is expected by mid-1983. Sales efforts of the Key Lake partners also met with continuing success in 1982. SMDC announced in November that the Canadian government had approved sales contracts totaling 14.5 million pounds $U_3O_8$. The press release stated that "SMDC's share of the Key Lake project is largely committed through 1986 and is approximately 75 percent committed for the period from the startup until 1990." SMDC owns 50 percent of Key Lake; Uranerz owns 33-1/3 percent and Eldorado Nuclear owns 16-2/3 percent. All partners have achieved considerable sales successes and remain aggressive and competitive in the marketplace.

## FAR EAST

**Japan** has produced its first domestic $UF_6$ from the PNC (Power Reactor and Nuclear Fuel Development Corporation) pilot plant at Ningyo Pass. The plant employs a unique technology, developed by PNC, in which uranium ore bypasses the concentrates stage. PNC plans to increase capacity at the combination refinement-conversion facility to 200 metric tons per year.

* * *

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Construction of Chubu Electric Power Company's Hamaoka Unit 3 (1,100 MWe BWR) has begun. Scheduled to begin commercial operations in 1986, it would give Chubu almost 2,500 MWe of nuclear generating capacity, approximately 11 percent of the company's total electrical output.

## UNITED STATES

### Summary

The US uranium industry continued during 1982 the liquidation trend established in 1981, as several holders of substantial amounts of inventory acted aggressively during the year to dispose of them. Further contraction of the industry was seen in the producer sector. Although some producers see the recent upturn in price, and a balanced supply-demand ratio, as hopeful signs for the future, it would be premature to suggest that this foreshadows an upward price trend or that a healthy US uranium market is probable in the near term.

### Production Cutbacks

US uranium production declined in 1982 to 25.4 million pounds $U_3O_8$. This figure represents a 30 percent decline since 1981. Nuexco's US production forecast anticipates an additional 40 percent decline in 1983, to 14.6 million pounds $U_3O_8$. A reaction to the sustained drop in price since 1979 prompted continued cutbacks and shutdowns by producers during the year, and that trend is continuing. Those which took place in 1982 are listed in chronological order, among other significant 1982 activities of US producers, in Table 17 on page 32 of this Report's *Raw Materials* section.

### Price Upturn

Nuexco's Exchange Value came nearly full circle in 1982, starting at $23.50 in January, declining steadily to $17.00 in August and September, and finishing at $20.25 on December 31. Many US utilities have perceived this price pattern as an end to declining prices. There is renewed interest on the part of US buyers to purchase under long-term contracts at present price levels before a sustained increase in price develops. This recent upsurge in demand on the part of US (and non-US) buyers has caused a dramatic recovery in the active supply-demand ratio from an imbalanced 16.2:1 as of June 30 to an almost ideal 1:1 as of November 30.

Among the many reasons for the sudden reversal of the US supply-demand situation, the most obvious is the subsidence of selling pressure which several inventory holders had been putting on the market. Earlier in the year, more than half of the total available supply might have been offered by US inventory holders. As of the end of December, the single inventory seller is offering for sale just 500 thousand pounds $U_3O_8$. That quantity amounts to less than one percent of US commercial inventories of uranium. According to Nuexco's latest estimate, US commercial inventories currently amount to approximately 147 million pounds $U_3O_8$. This figure includes all commercial inventories not in the fabrication pipeline, including concentrates, natural $UF_6$ and enriched $U_3O_8$.

### Producers' Purchases

Due to the fact that spot prices were, for the greater part of the year, lower than the production costs of many US producers, several producers found it prudent to purchase uranium to meet their existing contractual obligations and to cease further market activity. During the year, nine US producers purchased a total of approximately 9 million pounds $U_3O_8$, some of which was in the form of $UF_6$.

### Effect of Attempt to Limit Imports

The decision by some of the remaining US producers to cease marketing activity may have been influenced by recent attempts on the part of Senator Domenici to reestablish an import quota. Although the House of Representatives emphatically rejected the proposed embargo measure by a vote of 241-148, the possibility of an import restriction encouraged the US producers to slow their marketing activities pending the outcome of the legislation. In other cases, US producers felt pressured in the long-term market by foreign, especially Canadian, competition for US market share. Evidence of the Canadian marketing activity in the US is reflected by the fact that Canadian producers won several important long-term uranium sales contracts with US buyers.

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## Table 6

## UNITED STATES NUCLEAR POWER PLANTS: LICENSING PROGRESS IN 1982

### COMMERCIAL OPERATION

| Plant | Utility | Net MWe | Type | COD |
|---|---|---|---|---|
| Sequoyah 2 | TVA | 1148 | PWR | 6/82 |

### FULL POWER OPERATING LICENSES ISSUED

| Plant | Utility | Net MWe | Type |
|---|---|---|---|
| LaSalle 1 | Commonwealth Edison | 1078 | BWR |
| Susquehanna 1 | Pennsylvania P&L | 1050 | BWR |
| San Onofre 2 | So. California Edison | 1000 | PWR |
| Summer | So. Carolina | 900 | PWR |

### LOW POWER TESTING LICENSES ISSUED

| Plant | Utility | Net MWe | Type |
|---|---|---|---|
| Grand Gulf 1 | Middle South | 1250 | BWR |
| San Onofre 3 | So. California Edison | 1000 | PWR |

### Nuclear Power Progress in 1982

Construction delays and financial difficulties continued to plague US utilities in 1982. Only one reactor, TVA's Sequoyah Unit 2, went into commercial operation in 1982. Additionally, only four full power licenses and two low power licenses were issued, representing a total capacity of 6300 megawatts. The licensing progress of US nuclear power reactors during 1982 is summarized in Table 6. During that same period, nine reactors experienced delays, five were indefinitely deferred and nineteen were cancelled. The total generating capacity cancelled is 23,000 megawatts. Table 7 lists the delays, deferrals and cancellations experienced by US reactors in 1982.

Table 8 lists the US reactors under construction in descending order of completion percentage. Nuexco forecasts call for cancellation of at least 15 reactors now under construction or on order. This represents approximately 17,800 megawatts of generating capacity and approximately 6 million pounds of $U_3O_8$ average annual consumption. The USNRC estimates 21 reactors will receive operating licenses during 1983, representing a total of 23,000 megawatts. The estimates include five reactors which were originally scheduled to receive operating licenses in late 1982.

### Outlook for 1983

The US market is experiencing a time of uncertainty and instability. Recent signals that spot prices are increasing have caused a change in psychology which may, in itself, prove to be sufficient to maintain an upward pressure on price. However, the rise in the spot price should be watched carefully due to the large amount of inventory still overhanging the market now and in the near term. Price fluctuations will correlate with the rate at which these inventories are introduced into the market. Full recovery is expected to follow a series of ups and downs, spanning a period of several years.

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## Table 7

## UNITED STATES NUCLEAR POWER PLANTS: DELAYS, DEFERRALS AND CANCELLATIONS IN 1982

| | | Net | | Delay | | No. of |
|---|---|---|---|---|---|---|
| **Plant** | **Utility** | **NWe** | **Type** | **From** | **To** | **Months** |
| **PROJECTS DELAYED AT LEAST ONE YEAR** | | | | | | |
| Bellefonte 2 | TVA | 1213 | PWR | 2/88 | 11/89 | 21 |
| Catawba 1 | Duke Power | 1145 | PWR | 3/84 | 6/85 | 15 |
| Catawba 2 | Duke Power | 1145 | PWR | 9/85 | 6/87 | 21 |
| Clinton 1 | Illinois Power | 950 | BWR | 8/83 | 8/84 | 12 |
| Diablo Canyon 2 | Pacific G&E | 1106 | PWR | -/82 | -/83 | 12 |
| Limerick 2 | Philadelphia Elec. | 1055 | BWR | -/87 | -/90 | 36 |
| River Bend 1 | Gulf States | 940 | BWR | 4/84 | 12/85 | 20 |
| WNP 3 | WPPSS | 1240 | PWR | 12/86 | open | 24-60 |
| Zimmer 1 | Cincinnati G&E | 810 | BWR | -/83 | -/84 | 12 |
| **PROJECTS INDEFINITELY DEFERRED** | | | | | | |
| Hartsville A1 | TVA | 1233 | BWR | 4/91 | indef | — |
| Hartsville A2 | TVA | 1233 | BWR | 4/92 | indef | — |
| WNP 1 | WPPSS | 1250 | PWR | 6/86 | indef | — |
| Yellow Creek 1 | TVA | 1285 | PWR | 10/90 | indef | — |
| Yellow Creek 2 | TVA | 1285 | PWR | — | indef | — |

### PROJECTS CANCELLED

| Plant | Utility | Net MWe | Type | % Complete at Cancel. | Cost |
|---|---|---|---|---|---|
| Allens Creek | Houston L&P | 1200 | BWR | 0 | $326 million |
| Black Fox 1 | PS Oklahoma | 1150 | BWR | 0 | $300 million |
| Black Fox 2 | PS Oklahoma | 1150 | BWR | 0 | for 2 units |
| Cherokee 2 | Duke Power | 1280 | PWR | 0 | $68 million |
| Cherokee 3 | Duke Power | 1280 | PWR | 0 | for 2 units |
| Hartsville B1 | TVA | 1233 | BWR | 17 | $1.8 billion |
| Hartsville B2 | TVA | 1233 | BWR | 7 | for 4 TVA units |
| Hope Creek 2 | PS Elec. & Gas | 1067 | BWR | 18 | $172 million |
| Pebble Springs 1 | Portland GE | 1260 | PWR | 0 | $242 million |
| Pebble Springs 2 | Portland GE | 1260 | PWR | 0 | for 2 units |
| Perkins 1 | Duke Power | 1280 | PWR | 0 | $6.5 million |
| Perkins 2 | Duke Power | 1280 | PWR | 0 | for 3 units |
| Perkins 3 | Duke Power | 1280 | PWR | 0 | |
| Phipps Bend 1 | TVA | 1233 | BWR | 27 | See reference |
| Phipps Bend 2 | TVA | 1233 | BWR | 5 | above for TVA |
| North Anna 3 | Vepco | 907 | PWR | 9 | $566 million |
| Vandalia | Iowa P&L | 1270 | PWR | 0 | $8 million |
| WNP 4 | WPPSS | 1250 | PWR | 27 | $3 billion |
| WNP 5 | WPPSS | 1240 | PWR | 14 | for 2 units |

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## Table 8

## STATUS[1] OF US NUCLEAR REACTORS UNDER CONSTRUCTION

| Reactor | Utility | Percent Complete | Planned COD[2] |
|---|---|---|---|
| Diablo Canyon 1 | Pacific G&E | 100 | 10/83 |
| LaSalle 1 | Commonwealth Edison | 100 | 2/83 |
| Summer 1 | So. Carolina E&G | 100 | 10/83 |
| Grand Gulf 1 | Middle South Utilities | 99 | 2/83 |
| San Onofre 2 | So. California Edison/San Diego G&E | 98 | 3/83 |
| Zimmer 1 | Cincinnati G&E | 97 | -/84 |
| Palo Verde 1 | Arizona PS | 97 | 5/83 |
| Waterford 3 | Louisiana P&L | 94 | 7/83 |
| Susquehanna 1 | Pennsylvania P&L | 93 | 5/83 |
| McGuire 2 | Duke Power | 92 | 10/83 |
| Diablo Canyon 2 | So. California Edison/San Diego G&E | 91 | 4/84 |
| WNP 2 | WPPSS | 90 | 2/84 |
| Shoreham | Long Island Lighting | 90 | 3/83 |
| Fermi 2 | Detroit Edison | 90 | 11/83 |
| Catawba 1 | Duke Power | 89 | 6/85 |
| San Onofre 3 | So. California Edison/San Diego | 89 | 12/83 |
| Comanche Peak 1 | Texas Utilities | 88 | -/84 |
| St. Lucie 2 | Florida P&L | 88 | 5/83 |
| LaSalle 2 | Commonwealth Edison | 85 | 10/83 |
| Palo Verde 2 | Arizona PS | 85 | 5/84 |
| Clinton 1 | Illinois Power | 83 | 8/84 |
| Perry 1 | Cleveland Electric | 82 | 5/84 |
| Watts Bar 1 | TVA | 81 | 11/84 |
| Callaway 1 | Union Electric | 80 | 4/84 |
| Bryon 1 | Commonwealth Edison | 80 | 2/84 |
| Midland 1 | Consumers Power | 80 | 7/84 |
| Midland 2 | Consumers Power | 80 | 12/83 |
| Bellefonte 1 | TVA | 79 | 11/86 |
| Wolf Creek | Kansas G&E | 77 | 5/84 |
| Limerick 1 | Philadephia Electric | 74 | 4/85 |
| Seabrook 1 | PS New Hampshire | 70 | 2/84 |
| Bellefonte 2 | TVA | 65 | 11/89 |
| Susquehanna 2 | Pennsylvania P&L | 65 | -/84 |
| Bryon 2 | Commonwealth Edison | 64 | 2/85 |
| Shearon Harris 1 | Carolina P&L | 64 | 9/85 |
| WNP 1 | WPPSS | 63 | indef |
| Braidwood 1 | Commonwealth Edison | 62 | 10/85 |
| South Texas 1 | Houston L&P | 60 | -/86 |
| WNP 3 | WPPSS | 54 | 12/86 |
| Beaver Valley 2 | Duquesne L&P | 53 | 5/86 |
| Watts Bar 2 | TVA | 52 | 12/85 |

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## Table 8

## STATUS[1] OF US NUCLEAR REACTORS UNDER CONSTRUCTION

| Reactor | Utility | Percent Complete | Planned COD[2] |
|---|---|---|---|
| Hope Creek 1 | PS Electric & Gas | 50 | 12/86 |
| River Bend 1 | Gulf States Utilities | 50 | 12/85 |
| Comanche Peak 2 | Texas Utilities | 49 | -/85 |
| Braidwood 2 | Commonwealth Edison | 48 | 10/86 |
| Millstone 3 | Northeast Utilities | 45 | 5/86 |
| Nine Mile Point 2 | Niagara Mohawk Power | 44 | 10/86 |
| Hartsville A1 | TVA | 44 | indef |
| Perry 2 | Cleveland Electric | 42 | 5/88 |
| Catawba 2 | Duke Power | 42 | 6/87 |
| Palo Verde 3 | Arizona PS | 39 | 5/86 |
| Yellow Creek 1 | TVA | 35 | indef |
| Marble Hill 1 | PS Indiana | 35 | -/86 |
| Hartsville A2 | TVA | 34 | indef |
| Vogtle 1 | Georgia Power | 32 | 3/87 |
| Limerick 2 | Philadelphia Electric | 30 | -/90 |
| Phipps Bend 1 | TVA | 27 | indef |
| South Texas | Houston L&P | 23 | -/86 |
| Grand Gulf 2 | Middle South Utilities | 22 | indef |
| Seabrook 2 | PS New Hampshire | 20 | 5/86 |
| Cherokee 1 | Duke Power | 18 | indef |
| Marble Hill 2 | PS Indiana | 17 | -/87 |
| Vogtle 2 | Georgia Power | 9 | 9/88 |
| Phipps Bend 2 | TVA | 5 | indef |
| Shearon Harris 2 | TVA | 4 | 3/89 |
| Yellow Creek 2 | TVA | 3 | indef |
| Carroll County 1 | Commonwealth Edison | 0 | -/99 |
| Carroll County 2 | Commonwealth Edison | 0 | -/2000 |
| River Bend 2 | Gulf States Utilities | 0 | indef |
| Skagit 1 | Puget Sound P&L | 0 | -/91 |
| Skagit 2 | Puget Sound P&L | 0 | -/93 |

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[1] Information from Nuclear News World List as of August 1982 and assorted printed articles.
[2] Commercial operating date.

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*ANALYSIS & COMMENTARY*

## FORECAST OF APPARENT FUTURE CONSUMPTION

### Introduction

This Report presents Nuexco's forecasts of Apparent Future Consumption of $U_3O_8$ and installed nuclear electric generating capacity, as of September 30, 1982. The forecasts are quantified in Tables 9 and 10, respectively, and are graphically depicted in Figures 1 and 2.

As used by Nuexco, the term "consumption" refers to a theoretical calculation of the $U_3O_8$ which will be effectively consumed annually in the operation of a given nuclear power plant, with time allowed for this fuel to proceed through the fuel cycle from the time of entering the $U_3O_8$-$UF_6$ conversion plant until the time that fabricated fuel is ready for reactor loading. In other words, it is Nuexco's estimate of the quantity of uranium that nuclear power plant operators would calculate as $U_3O_8$ required for their nuclear power plants with adequate allowance for fuel cycle processing time, *if they used the same assumptions as Nuexco's analysis.*

Apparent future consumption is not the same, however, as the unfilled requirements for uranium which nuclear power plant operators can be expected to purchase in the future. Unfilled requirements depend on existing inventories, past commitments for future deliveries, and individual utility procurement practices.

### Summary of Results

Europe has surpassed the US as the foremost consumer of uranium. Nuexco's forecast indicates apparent future consumption for Europe in 1982 will exceed that of the US by fully one-third. The forecast calls for that margin to grow slightly over the next ten years, to nearly 40 percent by 1991. That forecast differential is almost double the corresponding estimate from Nuexco's previous forecast, published in Report 164.

As of 1982, the US share of Free World annual apparent consumption is almost one-third. That share is forecast to remain above 30 percent throughout the ten-year forecast period. Europe's share is forecast to remain steady at approximately 44 percent. Therefore, the two regions taken together account for three-fourths of the Free World's apparent future consumption throughout the forecast period.

The Far East accounts for approximately one-sixth of the total throughout the period. The remainder of the Free World accounts for only 6-7 percent of the total apparent future consumption.

Nuexco's forecast estimates 1982 apparent future consumption for the Free World at 63.4 million pounds $U_3O_8$ equivalent. That figure is forecast to increase by almost 70 percent by 1988, to approximately 107 million pounds $U_3O_8$, and to reach a level of 110 million pounds by 1991.

### Methodology

The methodology used in developing Nuexco's forecasts of Apparent Future Consumption and installed nuclear electric generating capacity is summarized below:

1. The growth of uranium consumption is primarily dependent upon the growth of nuclear power generation. The growth of commercial nuclear power is principally determined by the following factors:
   a. Economic growth of industrial nations;
   b. Energy consumption of industrial nations;
   c. Electrical load growth of nations;
   d. National energy alternatives;
   e. Economics of nuclear power;
   f. The owner utility's financial condition and the estimated likelihood of relief from ratemaking bodies;
   g. Construction progress to date for individual nuclear plants and the owner utility's construction experience for conventional as well as nuclear units;
   h. International policies and proliferation controls;
   i. National political and environmental influences;
   j. Licensing and regulation;
   k. Societal constraints, such as the active opposition of anti-nuclear pressure groups.

2. These factors are first analyzed on a country-by-country basis, and then within each country, on a plant-by-plant basis. The initial results are then used to evaluate announced national plans or announced needs of individual utilities. At later stages, the results of the numerical analysis are revised according to subjective and judgmental analysis. Then, the Apparent Future Consumption is calculated for each reactor based on the following assumptions.

3. The principal variable that will affect apparent future consumption is the uranium tails assay from the enrichment plants. Under the DOE Adjustable Fixed Commitment (AFC) enrichment contract and the new Facility Requirements (FR) enrichment contract, electric utilities and other entities have the option, within limits, to specify the transaction tails assay for the uranium enrichment of their material. This variable tails assay option permits customers to minimize the cost of enriched uranium product by selection of an optimum tails assay. For example, if an electric utility purchased

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### Table 9

### APPARENT FUTURE CONSUMPTION[1]

(millions of pounds $U_3O_8$)

| BUYER GROUP | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 |
|---|---|---|---|---|---|---|---|---|---|---|
| United States | | | | | | | | | | |
| Reactors now operational | 19.1 | 19.1 | 19.1 | 19.1 | 18.8 | 18.5 | 18.2 | 17.9 | 17.7 | 17.4 |
| Now under construction | 1.8 | 5.5 | 11.6 | 12.5 | 14.7 | 16.8 | 21.2 | 16.8 | 18.0 | 17.3 |
| Now on order/planned/future | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| US Subtotal | 20.9 | 24.6 | 30.7 | 31.6 | 33.5 | 35.3 | 39.4 | 34.7 | 35.7 | 34.7 |
| Europe | | | | | | | | | | |
| Reactors now operational | 21.0 | 21.3 | 21.3 | 21.0 | 21.0 | 20.8 | 20.4 | 20.2 | 20.0 | 19.3 |
| Now under construction | 6.9 | 13.0 | 15.2 | 22.0 | 20.9 | 20.6 | 21.9 | 22.0 | 21.0 | 21.3 |
| Now on order/planned/future | 0 | 0 | 0 | 0 | 0 | 1.3 | 2.6 | 4.2 | 5.9 | 7.5 |
| Europe Subtotal | 27.9 | 34.3 | 36.5 | 43.0 | 41.9 | 42.7 | 44.9 | 46.4 | 46.9 | 48.1 |
| Far East[2] | | | | | | | | | | |
| Reactors now operational | 7.6 | 7.6 | 7.6 | 7.4 | 7.2 | 7.0 | 6.9 | 6.8 | 6.6 | 6.4 |
| Now under construction | 3.2 | 3.2 | 3.5 | 4.7 | 6.0 | 5.2 | 4.9 | 6.1 | 6.0 | 5.2 |
| Now on order/planned/future | 0 | 0 | 0 | 0 | 1.2 | 2.8 | 3.9 | 4.6 | 4.0 | 8.0 |
| Far East Subtotal | 10.8 | 10.8 | 11.1 | 12.1 | 14.4 | 15.0 | 15.7 | 17.5 | 16.6 | 19.6 |
| Other Free World[3] | | | | | | | | | | |
| Reactors now operational | 2.8 | 2.8 | 2.8 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 1.9 | 1.9 |
| Now under construction | 1.0 | 1.4 | 1.8 | 1.6 | 2.2 | 3.8 | 3.6 | 3.1 | 3.2 | 3.2 |
| Now on order/planned/future | 0 | 0 | 0 | 0 | 0 | 1.2 | 0.9 | 1.0 | 2.0 | 2.4 |
| Other Subtotal | 3.8 | 4.2 | 4.6 | 4.0 | 4.6 | 7.4 | 6.9 | 6.5 | 7.1 | 7.5 |
| FREE WORLD[3] TOTAL | 63.4 | 73.9 | 82.9 | 90.7 | 94.4 | 100.4 | 106.9 | 105.1 | 106.3 | 109.9 |
| Worldwide Breakdown by Status | | | | | | | | | | |
| Reactors now operational | 50.5 | 50.8 | 50.8 | 49.9 | 49.4 | 48.7 | 47.9 | 47.3 | 46.2 | 45.0 |
| Now under construction | 12.9 | 23.1 | 32.1 | 40.8 | 43.8 | 46.4 | 51.6 | 48.0 | 48.2 | 47.0 |
| Now on order/planned/future | 0 | 0 | 0 | 0 | 1.2 | 5.3 | 7.4 | 9.8 | 11.9 | 17.9 |

---

[1] Computed quantities of $U_3O_8$ which would be used under the given conditions to fabricate fuel for loading and reloading reactors operational, under construction, on order, or forecasted as of September 30, 1982. Compiled and computed on a reactor by reactor basis. quantities for each reactor are based on specific core characteristics, 0.25% tails assay, no recycling, 24-month lead time for procuring first cores and 18-month lead time for procuring each reload. Estimates reflect annual consumption displaced in time to the start of the conversion-enrichment-fabrication cycle for timely loading into the reactor; they do not reflect refueling cycles.

[2] Japan, Korea, Taiwan, Philippines

[3] Excludes Bulgaria, Czechoslovakia, German Democratic Republic, Finland (two Russian reactors), Hungary, People's Republic of China, Poland, Romania, USSR

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## Table 10

## NUCLEAR ELECTRIC GENERATING CAPACITY[1] [2]
(thousands of MWe — net)

| **BUYER GROUP** | **1982** | **1983** | **1984** | **1985** | **1986** | **1987** | **1988** | **1989** | **1990** | **1991** |
|---|---|---|---|---|---|---|---|---|---|---|
| United States | | | | | | | | | | |
| Reactors now operational | 58.0 | 58.0 | 58.0 | 58.0 | 58.0 | 58.0 | 58.0 | 58.0 | 58.0 | 58.0 |
| Now under construction | 0 | 6.4 | 13.8 | 20.4 | 29.1 | 34.4 | 38.7 | 44.0 | 51.7 | 53.8 |
| Now on order/planned/future | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| US Subtotal | 58.0 | 64.4 | 71.8 | 78.4 | 87.1 | 92.4 | 96.7 | 102.0 | 109.7 | 111.8 |
| Europe | | | | | | | | | | |
| Reactors now operational | 54.5 | 54.5 | 54.5 | 54.5 | 54.5 | 54.5 | 54.5 | 54.5 | 54.5 | 54.4 |
| Now under construction | 5.1 | 13.7 | 18.9 | 27.9 | 37.5 | 48.3 | 55.8 | 59.6 | 63.5 | 63.5 |
| Now on order/planned/future | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.3 | 2.5 | 9.4 |
| Europe Subtotal | 59.6 | 68.2 | 73.4 | 82.4 | 92.0 | 102.8 | 110.3 | 115.4 | 120.5 | 127.3 |
| Far East[3] | | | | | | | | | | |
| Reactors now operational | 20.7 | 20.7 | 20.7 | 20.7 | 20.7 | 20.7 | 20.7 | 20.7 | 20.7 | 20.7 |
| Now under construction | 0 | 0 | 3.0 | 5.8 | 9.6 | 11.8 | 14.5 | 16.3 | 16.3 | 17.2 |
| Now on order/planned/future | 0 | 0 | 0 | 0 | 0 | 0 | 1.1 | 2.7 | 5.7 | 8.7 |
| Far East Subtotal | 20.7 | 20.7 | 23.7 | 26.5 | 30.3 | 32.5 | 36.3 | 39.7 | 42.7 | 46.6 |
| Other Free World[4] | | | | | | | | | | |
| Reactors now operational | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 |
| Now under construction | 0 | 0.9 | 2.3 | 4.3 | 6.4 | 7.7 | 8.7 | 10.7 | 12.5 | 13.4 |
| Now on order/planned/future | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.2 | 1.8 | 2.7 |
| Other Subtotal | 8.0 | 8.9 | 10.3 | 12.3 | 14.4 | 15.7 | 16.7 | 19.9 | 22.3 | 24.1 |
| FREE WORLD[4] TOTAL | 146.3 | 162.2 | 179.2 | 199.6 | 223.8 | 243.4 | 260.0 | 277.0 | 295.2 | 309.8 |
| Worldwide Breakdown by Status | | | | | | | | | | |
| Reactors now operational | 141.2 | 141.2 | 141.2 | 141.2 | 141.2 | 141.2 | 141.2 | 141.2 | 141.2 | 141.1 |
| Now under construction | 5.1 | 21.0 | 38.0 | 58.4 | 82.6 | 102.2 | 117.7 | 130.6 | 144.0 | 147.9 |
| Now on order/planned/future | 0 | 0 | 0 | 0 | 0 | 0 | 1.1 | 5.2 | 10.0 | 20.8 |

[1] Installed as of year end

[2] Uses Nuexco's estimates of commercial operating dates

[3] Japan, Korea, Taiwan, Philippines

[4] Excludes Bulgaria, Czechoslovakia, German Democratic Republic, Finland (two Russian reactors), Hungary, People's Republic of China, Poland, Romania, USSR

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*ANALYSIS & COMMENTARY*

Figure 1

FREE WORLD APPARENT FUTURE CONSUMPTION
(Millions of Pounds $U_3O_8$ Equivalent)

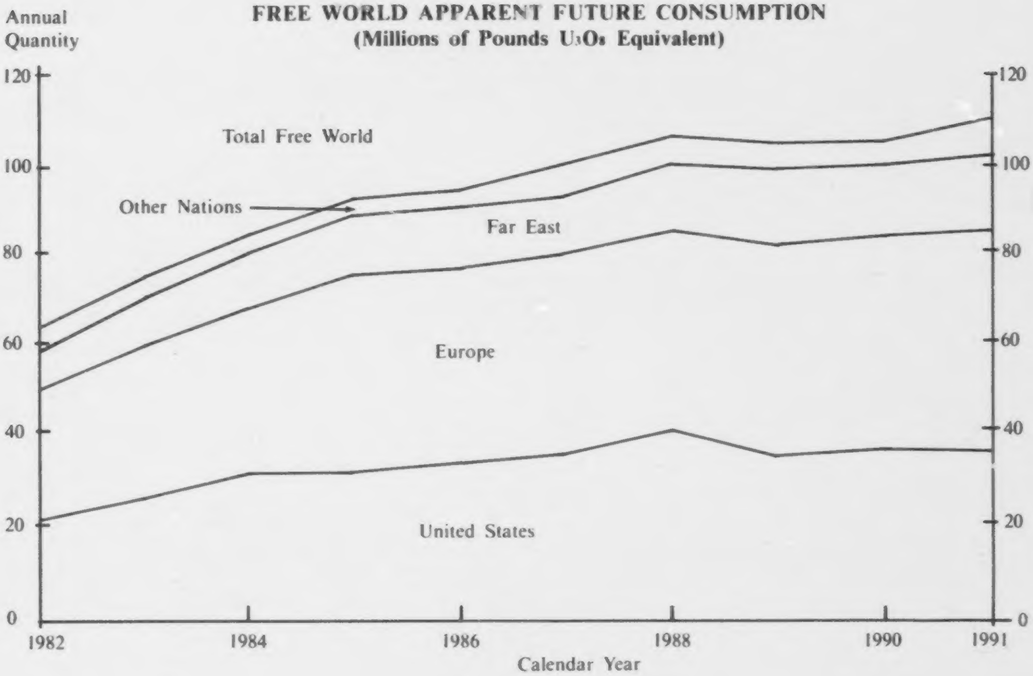
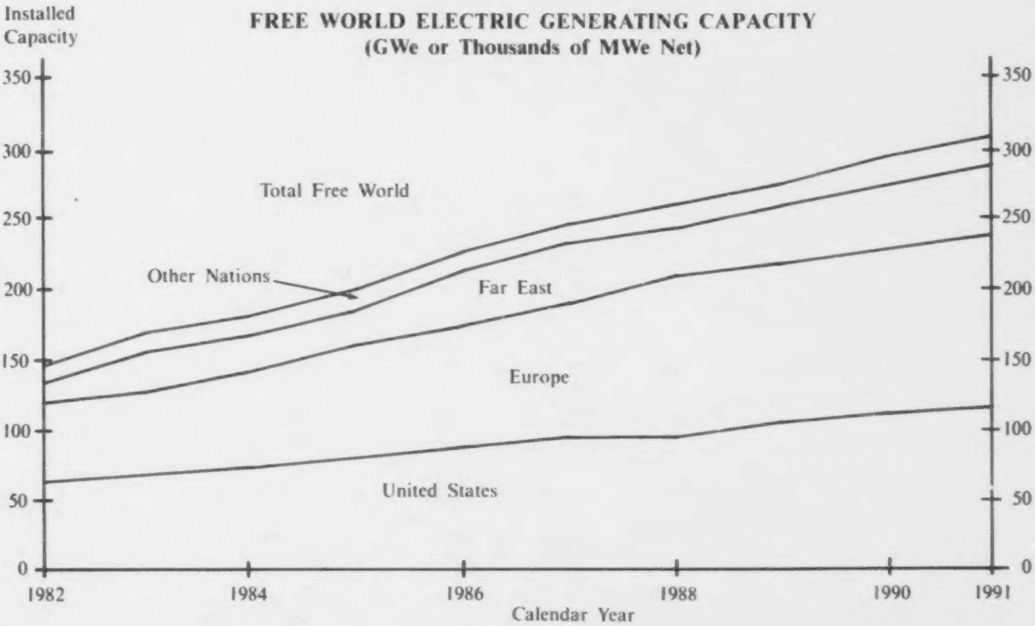


Figure 2

FREE WORLD ELECTRIC GENERATING CAPACITY
(GWe or Thousands of MWe Net)



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uranium in November 1982 at a cost of $17.50 per pound $U_3O_8$ for enrichment in May 1983 with a Separative Work Unit (SWU) price of $138.65 per kilogram of uranium, the optimum tails assay would be about 0.34 percent. This compares with a 0.20 percent constant tails assay for DOE Requirements contracts.

The rise in optimum tails assay in the enrichment process reflects the recent declining price of $U_3O_8$ compared with concurrent escalation of the enrichment cost. A tails assay of 0.31 percent requires about 22 percent more $U_3O_8$ feed than the 0.20 percent tails assay; however, the smaller number of SWUs required for enrichment results in a lower cost of enriched product. The Nuexco consumption forecasts in Table 9 reflect the use of a 0.25 percent tails assay which represents the approximate average expected in the future.

4. Capacity factor for each reactor is estimated according to historical performance of each reactor type. The historical tabulation of capacity factor for four reactor types, for the years 1968 through 1981, is as shown in Table 11.

After assessing those records, Nuexco chose the capacity factor estimates shown in Table 12.

**Table 12**

**NUCLEAR PLANT CAPACITY FACTOR ESTIMATES**

| Reactor Type | Percent |
|---|---|
| Boiling water reactor (BWR) | 65 |
| Pressurized water reactor (PWR) | 65 |
| Heavy water reactor (HWR) | 75 |
| Gas-cooled reactor (GCR) | 55 |
| Advanced gas-cooled reactor (AGCR) | 55 |

Nuexco has, in previous forecasts, characterized nuclear plant performance by regression analysis of capacity factors as a function of operating time, refueling periods and other parameters. Studies by other organizations have also described nuclear plant performance by functions representing plant startup periods, normal operating periods and end-of-life operating periods. It is Nuexco's opinion that none of these studies have developed sufficiently reliable predictive measures of nuclear plant operating performance. Large nuclear plants in initial operating periods have performed as well as smaller plants in mid-operating life. In fact, the variable that best correlates with plant performance is the capability of operating and maintenance staff. Since staff performance is difficult to quantify, Nuexco has elected in this study to use a constant nominal capacity factor for each reactor type.

Use of the Nuexco estimates of plant capacity factors shown in Table 12 increases uranium consumption requirements by about 10 percent as compared to earlier Nuexco forecasts. Those studies estimated capacity factor based on a regression analysis as a function of plant life. That method penalized the large nuclear plants early in their life cycle and rewarded the small plants late in their life cycle. Since the large nuclear plants consume the majority of the uranium, this effect lowered previous uranium consumption forecasts.

**Table 11**

**HISTORICAL TABULATION[1] OF NUCLEAR PLANT CAPACITY FACTOR (in percent) BY REACTOR TYPE**

| Reactor Type | Average Annual Capacity Factor | Weighted Average Annual Capacity Factor | Number and Output of Reactors |
|---|---|---|---|
| BWR | 60.1 | 60.0 | 56 (41,544 MWe) |
| PWR | 60.6 | 59.4 | 97 (78,848 MWe) |
| HWR | 74.5 | 83.2 | 13 ( 6,526 MWe) |
| GCR | 48.0 | 48.2 | 26 ( 8,515 MWe) |

[1] Nuclear Engineering International, October 1982

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5. Potential improvements in fuel utilization are forecast as shown in Table 13.

Nuexco forecasts of apparent future consumption reflect the uranium utilization savings of Table 13 in all Free World light water reactors which entered service after December 1968. The net result of these forecast nuclear physics improvements is a reduction of annual uranium consumption of about 16 percent by 1990 in those nations which have predominantly light water reactor power plants, such as France, Germany and Japan, and the US.

A similar approach was followed for heavy water reactor plants, where modest improvements in uranium utilization were assumed by 1985, but larger gains were instituted by 1990 through the use of slightly enriched uranium (1.20 percent $U_{235}$) in reload fuel. For conservatism, no improvements were assumed for gas-cooled reactor plants.

6. The forecasts assume that:

a. $U_3O_8$ deliveries for first cores predate commercial operation by two years;

b. First reload follows installation of first core by 12 months;

c. $U_3O_8$ delivery for first reload predates refueling outage by 12 months.

7. Using the assumptions listed above, the consumption for a given reactor can be computed as a function of thermal power, capacity factor, fuel exposure, enrichment level, process losses, tails assay and commercial operating date.

8. Actual commercial operating dates can vary widely from published dates. Nuexco uses the best information available, much of it from unpublished sources, to prepare its own forecasts of operating dates. Such information often changes more frequently than does public information; Nuexco attempts to anticipate such changes as much as possible.

9. The fuel cycles considered in this analysis are once-through systems which involve the storage or disposal of spent nuclear fuel. It is recognized that several countries have reprocessing facilities and are currently reprocessing nuclear fuel. However, the extracted uranium and plutonium from these facilities that will be recycled is not significant over the forecast period and has been excluded from the results of this study.

**Limitations**

Limitations of the forecasts detailed in Tables 9 and 10 are as follows:

1. Forecasts of Apparent Future Consumption are not forecasts of actual uranium demand. Rather, these forecasts comprise a portion of uranium demand more commonly referred to as reactor demand or reactor requirements. As indicators of the amount of uranium which will be needed to fuel the reactors under consideration, these forecasts should be regarded as relatively hard demand in the sense that this portion of demand is quite insensitive to uranium prices. Market demand for the assumed pattern of capacity additions can be higher or lower, depending on users' inventory policies.

2. Factors which can cause demand to exceed Apparent Future Consumption are:

a. Utility buyers plan their procurement strategies to achieve a very high probability of having access to at least enough uranium to meet commitments as they arise;

**Table 13**

**NUCLEAR FUEL IMPROVEMENTS IN LIGHT WATER REACTORS**

| **Year** | **$U_3O_8$ Requirements for Equilibrium Reload Fuel (Millions of Pounds $U_3O_8$ per Gigawatt-Year** | | **$U_3O_8$ Utilization Savings[1] (Percent)** | |
|---|---|---|---|---|
| | **BWR** | **PWR** | **Reference BWR** | **Reference PWR** |
| 1980 | 0.395 | 0.369 | | |
| 1985 | 0.359 | 0.349 | 9.1 | 5.4 |
| 1990 | 0.308 | 0.325 | 22.0 | 11.9 |
| 1995 | 0.308 | 0.325 | 22.0 | 11.9 |

[1] At 0.25% tails assay and 65% plant capacity factor

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b. Accelerated reactor construction schedules can advance the dates of uranium need;

c. Buyers may elect to purchase uranium in excess of need, simply to enhance security of supply;

d. Utility obligations to suppliers of fuel cycle services such as conversion, enrichment or fabrication, may require earlier purchase of uranium than a reactor's operating schedule would otherwise indicate.

3. Demand can fall short of Apparent Future Consumption if uranium inventories are reduced in order to fill needs which would otherwise appear as demand.

4. Reactors fueled by the USSR are excluded from Nuexco's forecasts. Although Soviet bloc reactors account for substantial demand, Soviet participation in uranium trading in the Western market has been negligible and appears likely to remain so.

5. Nuexco forecasts include provisions for some US reactor plant orders which have not yet been placed, but they have no effect on consumption or installed capacity until after 1991. Nuexco forecasts include provisions for the startup of some reactors not yet ordered in France and Japan. Those units are included based on the shorter construction cycles prevalent in those countries. Also, their planning and approval processes are such that substantial site and engineering planning is done before actual orders are placed.

## SUPPLY AND DEMAND ANALYSIS

The supply-demand analysis resulting from Nuexco's most recent forecasts of production and consumption of uranium is presented in Table 14 (Free World) and Table 15 (US). Conclusions which may be drawn from the analysis include the following:

1. Table 14 shows forecast world production of $U_3O_8$ exceeding forecast consumption in each year through 1986 but, after 1982, not by large margins. Therefore, for the first half of the ten-year forecast period, the relatively small cumulative imbalance between supply and demand can be relieved by annual additions to inventory.

2. During the second half of the forecast period, Table 14 indicates the opposite situation. In each year of the period 1987-1991, forecast consumption exceeds forecast production by margins much smaller than the supply excess of the period 1982-1986. Thus, the relatively insignificant supply shortfalls can be filled by withdrawals from inventory.

3. The comparison in Table 14 of Nuexco's forecasts of Free World production and consumption depicts a worldwide uranium industry on the verge of achieving intermediate-term to long-term stability. Although spot or near-term imbalances may still occur, Nuexco's latest forecasts indicate that they will be temporary.

This outlook is quite different from that of Nuexco's forecast of just a year ago. That forecast, published in Table 6 of Report 159, anticipated a steadily rising world inventory exceeding 600 million pounds $U_3O_8$ by 1989. The persistence of higher production estimates in the face of rising costs, high inventories and low prices was due to the increased time delay associated with captive producers' responses to the market. During the past year, several captive producers have given indications that they are reducing output in response to the market, so Nuexco's current forecast calls for a cumulative reduction of almost ten percent in uranium production over the period 1982-1990. In addition, certain positive developments, such as the "Konvoy" concept in West Germany, have led to increases in the forecast of consumption. Their combined effects have led to a current forecast of 1991 beginning inventory (457 million pounds) that is 25 percent below that published in Report 159 (616 million pounds).

4. The estimated inventory of approximately 400 million pounds $U_3O_8$ equivalent as of January 1, 1982 represents approximately five years of forward consumption. The forecast Free World inventory of 438 million pounds as of January 1, 1983 also represents five years of forward consumption. *Relative inventory* is forecast to decrease steadily throughout the remainder of the ten-year period to a level of four years' consumption.

5. New reactor orders or political or national policy considerations may generate enough additional demand to absorb production from production centers planned, but not yet firmly committed. However, it is more likely that a major driving force behind any such additional production entering the market will be the displacement of higher-cost production centers.

6. The analysis in Table 15 (US) is of the same basic form as that of Table 14 (Free World), but the US analysis includes an adjustment for US import-export commitments (Table 16). It also takes account of Nuexco's opinion that US utilities will collectively maintain at least 18 months' forward consumption in inventory.

7. Table 15 shows US uranium consumption exceeding US uranium production in each year between 1983 and 1991. Forecast uranium production declines steadily through 1990, to little more than half the estimated 1982 level of approximately 26 million pounds $U_3O_8$.

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8. Forecast US consumption increases by almost 50 percent between 1983 and 1991, so that the 1991 level of 34.7 million pounds (apparent future consumption) is more than double the forecast US production of 16.9 million pounds $U_3O_8$.

9. Annual net imports offset some of the US production shortfalls, but Table 15 shows an annual supply deficit in each year beginning in 1983. Over the ten-year period, the forecast indicates a cumulative US supply deficit of 150 million pounds $U_3O_8$.

10. Assuming US utilities will reduce inventories to an average level of 1.5 years' relative inventory, the result is unfilled demand of 62.4 million pounds $U_3O_8$ between 1988 and 1991. Actually, the current maldistribution of US utility inventories will almost certainly persist, at least to some extent, so that unfilled demand will actually be larger than estimated and will take effect in earlier years. The inventory situation depicted in Table 15 would only apply if US utility inventories were perfectly liquid. In that situation, without additional US imports or more US production, US inventory would decline to 1.5 years' forward consumption by 1988.

### Table 14

### URANIUM SUPPLY-DEMAND BALANCE: WOCA[1]
**(millions of pounds $U_3O_8$ equivalent)**

| | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 |
|---|---|---|---|---|---|---|---|---|---|---|
| PRODUCTION[2] | | | | | | | | | | |
| Operating production centers | 102.5 | 87.2 | 85.1 | 85.8 | 86.6 | 85.5 | 84.6 | 84.8 | 84.4 | 88.6 |
| Facilities under construction | 0.7 | 3.2 | 8.9 | 9.6 | 13.3 | 13.3 | 14.2 | 13.8 | 13.8 | 13.1 |
| Planned facilities | 0 | 0 | 0 | 0 | 0.5 | 1.0 | 1.0 | 1.0 | 2.0 | 4.0 |
| Total | 103.2 | 90.4 | 94.0 | 95.4 | 100.4 | 99.8 | 99.8 | 99.6 | 100.2 | 105.7 |
| less | | | | | | | | | | |
| CONSUMPTION[3] | 63.4 | 73.9 | 82.9 | 90.7 | 94.4 | 100.4 | 106.9 | 105.1 | 106.3 | 109.9 |
| equals | | | | | | | | | | |
| NET INVENTORY INCREASE/(DECREASE) | 39.8 | 16.5 | 11.1 | 4.7 | 6.0 | (0.6) | (7.1) | (5.5) | (6.1) | (4.2) |
| plus | | | | | | | | | | |
| BEGINNING INVENTORY | 397.9[4] | 437.7 | 454.2 | 465.3 | 470.0 | 476.0 | 475.4 | 468.3 | 462.8 | 456.7 |
| equals | | | | | | | | | | |
| ENDING INVENTORY | 437.7 | 454.2 | 465.3 | 470.0 | 476.0 | 475.4 | 468.3 | 462.8 | 456.7 | 452.5 |
| RELATIVE INVENTORY (years)[5] | 4.9 | 5.0 | 4.8 | 4.7 | 4.6 | 4.5 | 4.4 | 4.3 | 4.1 | 4.0 |

[1] Excludes Communist areas
[2] Nuexco Report 172, Table 5
[3] This report, Table 9
[4] Nuexco estimate
[5] For each year, Relative Inventory equals the number of years of forward consumption which could be supplied by that year's Beginning Inventory.

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## Table 15
## SUPPLY-DEMAND BALANCE: US
## ONE AND ONE-HALF YEARS DESIRED RELATIVE INVENTORY
**(millions of pounds $U_3O_8$ equivalent)**

| | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 |
|---|---|---|---|---|---|---|---|---|---|---|
| PRODUCTION[1] | 25.9 | 14.7 | 12.0 | 12.4 | 12.3 | 12.0 | 12.4 | 12.6 | 13.4 | 16.9 |
| less | | | | | | | | | | |
| CONSUMPTION[2] | 20.9 | 24.6 | 30.7 | 31.6 | 33.5 | 35.3 | 39.4 | 34.7 | 35.7 | 34.7 |
| plus | | | | | | | | | | |
| NET IMPORTS/(EXPORTS)[3] | 3.5 | 6.0 | 3.0 | 1.7 | 1.9 | 1.9 | 2.3 | 2.4 | 2.4 | 2.4 |
| equals | | | | | | | | | | |
| SUPPLY SURPLUS/ (DEFICIT) | 8.5 | (3.9) | (15.7) | (17.5) | (19.3) | (21.4) | (24.7) | (19.7) | (19.9) | (15.4) |
| plus | | | | | | | | | | |
| BEGINNING INVENTORY | 138.8[4] | 147.3 | 143.4 | 127.7 | 110.2 | 90.9 | 69.5 | 56.8 | 52.6 | 53.1 |
| equals | | | | | | | | | | |
| NOMINAL INVENTORY | 147.3 | 143.4 | 127.7 | 110.2 | 90.9 | 69.5 | 44.8 | 37.1 | 32.7 | 37.7 |
| less | | | | | | | | | | |
| MINIMUM INVENTORY | 33.2 | 40.0 | 46.5 | 48.4 | 51.2 | 55.0 | 56.8 | 52.6 | 53.1 | 52.2 |
| equals | | | | | | | | | | |
| EXCESS INVENTORY/ (UNFILLED DEMAND) | 114.1 | 103.4 | 81.2 | 61.8 | 39.7 | 14.5 | (12.0) | (15.5) | (20.4) | (14.5) |
| ADJUSTED ENDING INVENTORY | 147.3 | 143.4 | 127.7 | 110.2 | 90.9 | 69.5 | 56.8 | 52.6 | 53.1 | 52.2 |
| RELATIVE INVENTORY (years)[5] | 4.9 | 4.8 | 4.3 | 3.7 | 3.1 | 2.5 | 1.9 | 1.5 | 1.5 | 1.5 |

[1] Report 172, Table 3
[2] This report, Table 9
[3] This report, Table 16
[4] Commercial inventory only. Nuexco Report 170, page 19, Table 3
[5] For each year, Relative Inventory equals the number of years of forward consumption which could be supplied by that year's Beginning Inventory.

## Table 16
## US URANIUM IMPORT-EXPORT BALANCE
**(millions of pounds $U_3O_8$)**
**(contracted as of 9/30/82)**

| | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 |
|---|---|---|---|---|---|---|---|---|---|---|
| IMPORTS | | | | | | | | | | |
| Annual | 9.5 | 9.9 | 5.4 | 3.7 | 3.3 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 |
| Cumulative | 9.5 | 19.4 | 24.8 | 28.5 | 31.8 | 34.2 | 36.6 | 39.0 | 41.4 | 43.8 |
| EXPORTS | | | | | | | | | | |
| Annual | 6.0 | 3.9 | 2.4 | 2.0 | 1.4 | 0.5 | 0.1 | 0.0 | 0.0 | 0.0 |
| Cumulative | 6.0 | 9.9 | 12.3 | 14.3 | 15.7 | 16.2 | 16.3 | 16.3 | 16.3 | 16.3 |
| NET IMPORTS | | | | | | | | | | |
| Annual | 3.5 | 6.0 | 3.0 | 1.7 | 1.9 | 1.9 | 2.3 | 2.4 | 2.4 | 2.4 |
| Cumulative | 3.5 | 9.5 | 12.5 | 14.2 | 16.1 | 18.0 | 20.3 | 22.7 | 25.1 | 27.5 |

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## SUMMARY OF US URANIUM ACTIVITIES—1982

### Drilling Activity

The continued decline in uranium exploration and development activities in 1982 can best be measured by comparing footage drilled in 1982 vs 1981. According to figures released by the US Department of Energy (DOE), 1981 drilling as reported by active companies totaled approximately 14 million feet for exploration and development projects. Based upon DOE's mid-1982 tabulation of less than three million feet, Nuexco is estimating that 1982 drilling will total 6 million to 6.5 million feet, less than half the 1981 total. Since labor and material costs have risen, the percentage decline in drilling expenditures will probably be somewhat less, about 40 to 45 percent below 1981.

The depressed market price for uranium concentrates is the principle reason given for companies pulling out of exploration and developing projects. Only the most favorable prospect areas have been retained in limited situations; otherwise, large property tracts have been completely dropped, including tracts with proven ore reserves. The major oil companies have led the exodus. After three major oil companies curtailed or terminated all uranium activities in 1981, there remained only fifteen oil companies aggressively pursuing uranium exploration and development projects as of January 1982. During the year, eight of them announced their intention to completely terminate uranium activities. The remaining seven have sharply curtailed their uranium activities. The smaller companies and independent operators have followed the trend. Termination of uranium activities, including many mining operations, has spread to all districts.

Overall, the potential uranium-bearing lands that have been dropped total hundreds of thousands of acres throughout the western US. The majority of acreage dropped consists of mining claims on public lands, many of which have been held for 20 to 25 years. The land has reverted to the public domain and is once again open to staking by any interested party. Other acreage dropped includes exploration and mining leases on privately-owned land.

The intensity of exploration and development activity has been cut back drastically in each district. The South Texas district, which was the most active for the last two years, well illustrates the state of US activity. In December 1981, there were about 23 companies active, 55 drills working and 13 producing projects. The count this December is ten active companies, 13 drills working, and 10 producing projects.

The situation is generally more critical in the other producing districts. New mine and mill construction has been postponed or abandoned; operating projects continue to cut back; and many companies have announced total abandonment of their uranium programs. According to information published by the Rocky Mountain Scout, there were 22 drills working on exploration projects as of December 1. Eighteen of those were drilling in Arizona, Nebraska and Wyoming. Of the three remaining drills, two were located in South Texas and one in the Grants Uranium Belt. This compares to 59 drills active on exploration projects one year earlier.

There were 26 drills operating on property development programs according to the same report. The main areas of activity were South Texas, where 11 rigs were drilling on 6 producing properties, Colorado Front Range, where 6 drills were located on one producing property, and Wyoming, where two rigs were drilling on a producing property and two on delineation of an undeveloped orebody. One year ago, there were a total of 41 operating drills scattered throughout the different producing districts.

### Resource Estimates

The availability of reasonably assured uranium resources (RAR) in the US has been reduced considerably as a result of the sustained market price decline that occurred in 1979-1982. Nuexco published its assessment of uranium reserves in a forward cost category of $20 or less per pound $U_3O_8$ in August 1982 (Nuexco Report 168) based on annual reserve figures released by USDOE as of January 1, 1982. DOE reclassified all reasonably assured resources (RAR) in the cost category of $15 or less per pound into the $30 or less cost category. The DOE estimate of RAR at $30 or less is 186,000 tonnes $U_3O_8$, a reduction of 56 percent below RAR as of January 1, 1981. Nuexco estimates RAR at $20 or less per pound at approximately 15,000 tonnes $U_3O_8$. This is less than 10 percent of the DOE estimate for RAR at $30 or less. However, it is noteworthy that Nuexco's estimate does not include newly discovered and totally undeveloped ore deposits which have yet to demonstrate favorable recovery techniques at competitive cost levels. In particular, the Crow Butte deposit in Nebraska and the Swanson deposit in Virginia are not yet included as RAR. Combined, the two deposits represent a potential to increase Nuexco's RAR estimate by about 34,000 tonnes $U_3O_8$.

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**Major Commercial Events**

The discovery of uranium in Pittsylvania County, Virginia, highlighted US exploration activity for 1982. **Marline Uranium Corporation**, a wholly-owned subsidiary of the Marline Oil Corporation, announced on July 21 the discovery of at least 30 million pounds $U_3O_8$ at an average grade exceeding four pounds $U_3O_8$ per ton of ore. In addition, large quantities of lower grade ore were identified in association with the main ore deposit. The discovery was important because it increased US reserves, but perhaps more importantly, it identified a new uranium province in the US, the first such discovery in the last 20 years. There is high potential to discover additional uranium deposits within the same geologic province.

Marline Uranium Corporation began exploration in the general area in 1977. Exploration drilling began in 1978 and the main discovery was made in 1979. Delineation of the orebody, named the Swanson deposit, required the drilling of more than 240 holes totaling over 124,000 feet. The mineralization occurs in metasediments (gniess) of the Fork Mountain Formation which is Precambrian-Lower Paleozoic in age. The ore occurrence is adjacent to the Chatham Fault, the major structural feature separating the older rocks from downfaulted Triassic sediments along the Danville Triassic Basin frontal system to the east.

Marline geologists discovered uranium on the surface at the discovery site. Drilling indicates the orebody plunges to the southeast to a depth exceeding 1000 feet. Pitchblende is the principal uranium mineral present in veins and fractures, and as discrete crystals dispersed within the granulated groundmass of the Fork Mountain Formation.

Marline Uranium Corporation of Danville, Virginia, and Union Carbide Corporation of Danbury, Connecticut, announced on December 9 an agreement between the two companies to evaluate uranium mineralization on properties that Marline has under lease in Pittsylvania County, Virginia. The two companies will jointly determine the economic feasibility of extracting and processing uranium ores from those properties. If the study results are favorable, Union Carbide has the option to develop this resource with Marline.

* * *

Ore reserves at the **Crow Butte** project, located in the northwest corner of Nebraska, have almost doubled since the discovery was announced in 1981. Independent ore reserve studies indicate an orebody containing over 44 million pounds $U_3O_8$, according to information published by joint venture partners Ferret Exploration Company (50 percent) and Wyoming Fuel Company, subsidiary of Kansas-Nebraska Natural Gas Company (50 percent). Uranium mineralization occurs in a paleochannel formed in basal units of the White River Formation of Tertiary age. The joint venture controls almost 90,000 acres in the area of interest.

Engineering and metallurgical studies indicate the deposit is amenable to solution mining techniques. The joint venture is progressing with development plans to construct a 100 gallon per minute in situ leach pilot plant to commence operations by the end of 1983. Assuming the pilot project is successful, development plans include permitting and construction of a commercial plant sometime in 1985 or 1986. Commercial production could total approximately one million pounds $U_3O_8$ annually, expanding to about two million pounds per year by the late 1980s.

* * *

Of interest throughout the uranium industry was the acquisition of 80 percent of **Pathfinder Mines, Inc.** by **French American Metals Corporation**, a wholly-owned subsidiary of Compagnie Generale des Matieres Nucleaires (Cogema). Pathfinder's parent company, Utah International Inc., announced on March 26 that the transaction encompassed all of Pathfinder's uranium interests, including two surface mines and a mill in the Gas Hills district and one mine and mill in the Shirley Basin district in Wyoming. Cogema has a five-year option to acquire the remaining 20 percent of Pathfinder. According to the announcement, the operating procedures of Pathfinder will not change in the near future. Present production is dedicated to long-term supply contracts with domestic and foreign utilities.

* * *

Other 1982 events that have had an effect on the US uranium industry are listed chronologically in Table 17.

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### Table 17

### 1982 US URANIUM DEVELOPMENTS

| Date | Company | Event |
|---|---|---|
| January | Atlas Corp. | Cutback in Utah mining and milling operation. About 34% of employees to be terminated. |
| January | Exxon | To discontinue uranium exploration. At Highland, Wyoming, surface mine and mill production will be reduced about 35 percent; the underground mine will be closed. |
| February | Western Nuclear Inc. | Reduced all mining and milling operations to four days per week. |
| February | Anaconda Co. | Made last ore shipment from the Jackpile mine area after 30 years' continuous production. |
| February | Wyoming Fuel Co. | Announced Crow Butte probable and potential ore reserves to be greater than 25 million pounds $U_3O_8$. |
| March | New Mexico & Arizona Land Co. | Let 40% interest in the Ruby #3 and #4 Mines, Grants Uranium Belt, N.M., revert to Western Nuclear. |
| March | US Congress | Domenici-sponsored amendment to NRC budget authorization bill to limit US utilities to 20% foreign uranium for fuel in each reactor passed the Senate vote. Amendment was forwarded to conference committee for review. |
| March | Union Carbide Corp. | Announced 5-month shutdown of Uravan, Colorado mill beginning mid-April. |
| April | Exxon Co. | Last ore shipment from Felder mine, Tx. Deposit considered mined-out. |
| April | Energy Fuels Ltd. | Received NRC authorization to produce up to 17,300 pounds $U_3O_8$ daily at its White Mesa, Utah, mill. |
| April | Plateau Resources Ltd. | Start-up of its Shootaring Canyon, Utah mill. Rated capacity equals 750 tons per day. |
| May | Homestake Mining Co. | Announced Ambrosia Lake, N.M. mill to cut operations from 5 to 4 days per week. Production to remain at same rate. |
| May | Gulf Oil Corp. | Transferred its Canadian uranium position to Eldorado for undisclosed amount uranium oxide. |
| May | UNC Resources | Announced suspension of production at Church Rock, N.M. mines and mill. |
| May | Conoco Inc. | Applied to EID of N.M. for permit to develop in situ leach project and a 1500 tpd mill at Crownpoint, N.M. |
| May | Gulf Mineral Resources Co. | Suspended further development of Mt. Taylor, N.M. mine. Production will continue at 400-500 tpd. |
| May | TVA | Announced plans to initiate mining on properties at Edgemont, S.D. between 1988 and 1991. |

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## Table 17

## 1982 US URANIUM DEVELOPMENTS

| Date | Company | Event |
|---|---|---|
| June | Exxon Co. | Planned phase-out of Highland, Wyoming project in 1983. |
| June | Gulf Mineral Resource Co. | Closed its mine at Mariano Lake, N.M. |
| June | Kerr-McGee Corp. | Development work on the Lee mine shaft, Ambrosia Lake, N.M., was suspended for 3 years. |
| June | Sunedco | Discontinuing its uranium exploration program. |
| July | Western Nuclear Inc. | Announced Ruby #3 and #4 Mines in the Grants Uranium Belt, N.M., and the Sherwood, WA mine and mill will be placed on standby. |
| July | Phillips Petroleum Corp. | Announced phase-out of all mineral projects, including uranium, by September. |
| July | Conoco, Inc. | Announced intention to terminate all mineral projects, including uranium. |
| July | Marline Uranium Corp. | Announced the discovery of 30 million pounds $U_3O_8$ in southern Virginia. |
| August | Kerr-McGee Corp. | Reduced operations in Ambrosia Lake by 30 percent. |
| August | Plateau Resources Ltd. | Announced the Shootaring Canyon, Utah mill would be closed immediately. |
| August | Atlas Corp. | Purchased Exxon's Shootaring Canyon property and ore reserves for royalty on future production. |
| August | Union Carbide Corp. | Will not reopen Uravan, CO, mill in September as planned. |
| August | Texaco Inc. | Began phase-out of uranium exploration activities. |
| September | Pioneer Nuclear, Inc. | Received radioactive materials license for its Slick Rock, CO, mill. Development plans are on standby. |
| September | Sohio Western Mining Co. | Negotiated termination of the L-Bar Joint Venture with Reserve Oil & Mineral Corporation. |
| September | Sohio Western Mining Co. | Radioactive materials license renewed for the Seboyeta, N.M. mill. |
| September | Union Carbide Corp. | Cutback on mining at Gas Hills, WY. Milling to continue. |
| October | Earth Sciences, Inc. | Sold 49 percent interest in uranium recovery plant (from phosphate) in Calgary, Alberta, to UG Canada. |
| October | Anaconda Co. | The Texas Department of Health has issued a radioactive source materials license for the Rhode Ranch project, South Texas. |
| October | Sohio Western Mining Co. | To phase out all uranium exploration. L-Bar project delegated to Kennecott Copper Corp. |

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*RAW MATERIALS*

**Table 17**

**1982 US URANIUM DEVELOPMENTS**

| Date | Company | Event |
|---|---|---|
| November | Gulf Mineral Resources Corp. | Reported a temporary halt of production at its Mt. Taylor, N.M. mine. |
| November | Union Carbide Corp. | Cutback on mining schedule in western Colorado and eastern Utah. |
| November | Dawn Mining Co. | Shut down milling operations, Ford, WA. |
| November | Kerr-McGee Corp. | Announced a 20 percent cutback in mining operations at Church Rock, N.M. Mill at Ambrosia Lake operating 8 days on, 6 days off. |
| December | US Congress | Passed revised version of NRC budget authorization bill which limits bill to study impact of uranium imports on domestic industry. Domenici import quota dropped from bill. |
| December | TVA | Purchased about 17,000 acres in Natrona and Fremont Counties, WY, from Federal-American partners. |
| December | Marline Uranium Corp. | Announced agreement with Union Carbide Corp. to jointly evaluate the Swanson orebody in Pittsylvania County, VA. |

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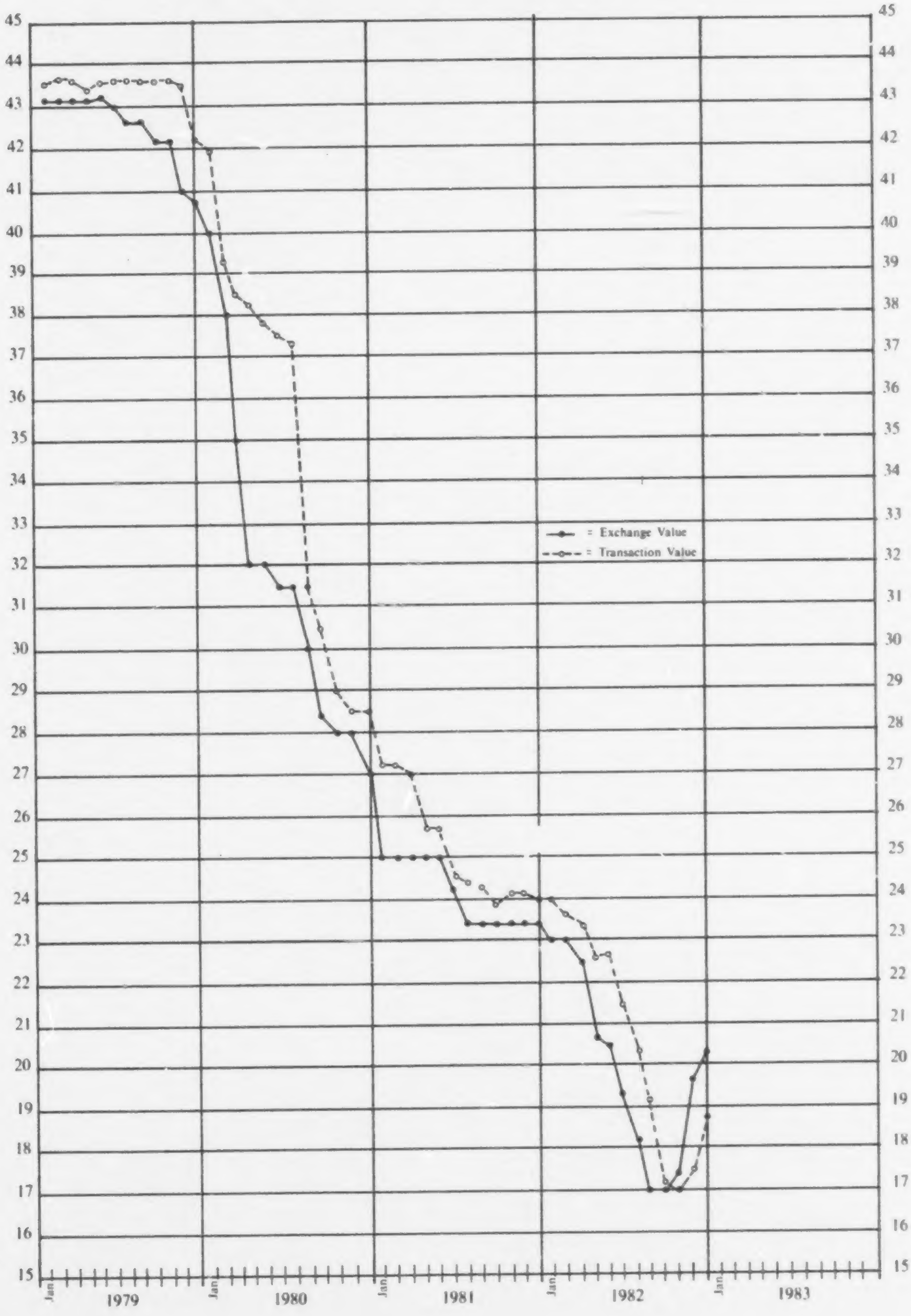
## EXCHANGE AND TRANSACTION VALUES
## SINCE JANUARY 1979

Determined as of the last day of the month indicated



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*HISTORICAL MARKET DATA*

## HISTORICAL EXCHANGE VALUES

Determined as of the last day of the month indicated (US Dollars/lb. $U_3O_8$)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1968 | — | — | — | — | — | — | — | 6.35 | 6.35 | 6.40 | 6.45 | 6.50 |
| 1969 | — | 6.35 | 6.10 | 6.10 | 6.25 | 6.25 | 6.20 | 6.20 | 6.15 | 6.15 | 6.15 | 6.20 |
| 1970 | 6.30 | 6.30 | 6.30 | 6.30 | 6.30 | 6.30 | 6.30 | 6.20 | 6.15 | 6.15 | 6.15 | 6.15 |
| 1971 | 6.20 | 6.20 | 6.20 | 6.20 | 6.15 | 6.05 | 6.00 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 |
| 1972 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 |
| 1973 | 5.95 | 6.00 | 6.10 | 6.20 | 6.45 | 6.50 | 6.50 | 6.50 | 6.50 | 6.50 | 6.75 | 7.00 |
| 1974 | 7.70 | 7.90 | 8.00 | 9.00 | 9.50 | 10.50 | 11.50 | 12.00 | 12.50 | 14.00 | 14.75 | 15.00 |
| 1975 | 16.00 | 16.00 | 18.00 | 20.00 | 21.00 | 23.00 | 24.70 | 26.00 | 26.00 | 28.50 | 30.00 | 35.00 |
| 1976 | 35.20 | 37.00 | 39.25 | 40.00 | 40.00 | 40.00 | 40.00 | 40.40 | 41.00 | 41.00 | 41.50 | 41.00 |
| 1977 | 41.35 | 41.50 | 41.60 | 41.60 | 42.00 | 42.25 | 42.25 | 42.25 | 42.40 | 42.75 | 43.20 | 43.20 |
| 1978 | 42.90 | 43.25 | 43.25 | 43.25 | 43.40 | 43.40 | 43.40 | 43.10 | 43.25 | 43.00 | 43.25 | 43.25 |
| 1979 | 43.25 | 43.25 | 43.25 | 43.25 | 43.25 | 43.00 | 42.70 | 42.70 | 42.20 | 42.20 | 41.00 | 40.75 |
| 1980 | 40.00 | 38.00 | 35.00 | 32.00 | 32.00 | 31.50 | 31.50 | 30.00 | 28.50 | 28.00 | 28.00 | 27.00 |
| 1981 | 25.00 | 25.00 | 25.00 | 25.00 | 25.00 | 24.25 | 23.50 | 23.50 | 23.50 | 23.50 | 23.50 | 23.50 |
| 1982 | 23.00 | 23.00 | 22.50 | 20.75 | 20.50 | 19.25 | 18.25 | 17.00 | 17.00 | 17.50 | 19.75 | **20.25** |

## HISTORICAL TRANSACTION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. $U_3O_8$)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1976 | — | — | — | — | 39.60 | 39.70 | 39.70 | 40.40 | 40.30 | 40.60 | 40.70 | 40.70 |
| 1977 | 41.30 | 41.30 | 41.40 | 41.50 | 42.80 | 42.90 | 43.00 | 42.60 | 42.50 | 42.80 | 42.90 | 42.90 |
| 1978 | 43.10 | 43.30 | 43.70 | 43.60 | 43.60 | 43.20 | 43.30 | 43.40 | 43.40 | 43.60 | 43.40 | 43.70 |
| 1979 | 43.60 | 43.80 | 43.70 | 43.40 | 43.60 | 43.70 | 43.70 | 43.60 | 43.60 | 43.60 | 43.50 | 42.30 |
| 1980 | 42.00 | 39.30 | 38.60 | 38.40 | 37.90 | 37.60 | 37.30 | 31.60 | 30.60 | 29.00 | 28.70 | 27.70 |
| 1981 | 27.20 | 27.20 | 27.00 | 25.70 | 25.70 | 24.50 | 24.40 | 24.30 | 23.90 | 24.10 | 24.10 | 24.00 |
| 1982 | 24.00 | 23.70 | 23.40 | 22.60 | 22.70 | 21.50 | 20.30 | 19.10 | 17.30 | 17.00 | 17.55 | **18.80** |

## EXCHANGE VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

| Country | per lb. $U_3O_8$ in Concentrates | per kg $U_3O_8$ in Concentrates | per kg U in Concentrates |
|---|---|---|---|
| US (dollar) | 20.25 | 44.64 | 52.65 |
| France (franc) | 136.00 | 299.82 | 353.56 |
| FRG (mark) | 48.09 | 106.02 | 125.02 |
| Japan (yen) | 4,732 | 10,433 | 12,303 |
| Switzerland (franc) | 40.40 | 89.06 | 105.02 |
| UK (pound) | 12.48 | 27.51 | 32.44 |
| Australia (dollar) | 20.62 | 45.46 | 53.61 |
| Canada (dollar) | 25.06 | 55.25 | 65.15 |
| Niger, Gabon (CFA) | 6,795 | 14,981 | 17,666 |
| South Africa (rand) | 21.76 | 47.98 | 56.58 |
| Sweden (kroner) | 147.49 | 325.15 | 383.43 |

[1] Calculated using currency exchange rates published in the Wall Street Journal on December 20, 1982.

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## AUSTRALIA

| | Price Index of Materials Used in Manufacturing Industry—All Groups (Year 1968-69 = 100.0)[1] | Weighted Average Minimum Weekly Wage Rates—Adult Males Australia Mining and Quarrying (A$)[2] |
|---|---|---|
| Annual Avg. 1971[3] | 101.5 | 65.95 |
| Annual Avg. 1972[3] | 105.6 | 71.26 |
| Annual Avg. 1973[3] | 124.4 | 78.96 |
| Annual Avg. 1974[3] | 141.9 | 108.07 |
| Annual Avg. 1975[3] | 150.4 | 132.55 |
| Annual Avg. 1976[3] | 168.4 | 160.93 |
| Annual Avg. 1977[3] | 192.0 | 179.03 |
| Annual Avg. 1978[3] | 198.5 | 190.04 |
| Annual Avg. 1979 | 248.8 | 196.34 |
| Annual Avg. 1980 | 321.8 | 218.00 |
| Annual Avg. 1981 | 355.3 | 237.34 |
| Jul 1981 | 357.8R | 237.86 |
| Aug 1981 | 360.9R | 154.1 R[2] |
| Sep 1981 | 358.4R | 154.4 R[2] |
| Oct 1981 | 352.5R | 155.0 R[2] |
| Nov 1981 | 351.3 | 156.8 R[2] |
| Dec 1981 | 349.9 | 166.6 R[2] |
| Jan 1982 | 354.9 | 168.2 R[2] |
| Feb 1982 | 356.7 | 168.9 R[2] |
| Mar 1982 | 360.3 | 169.2 R[2] |
| Apr 1982 | 367.7 | 169.2 R[2] |
| May 1982 | 367.6 | 169.7 R[2] |
| Jun 1982 | 367.2 | 170.2 R[2] |
| Jul 1982 | 369.1 | 174.5 R[2] |
| Aug 1982 | 371.5 | 175.1 R[2] |
| Sep 1982 | 374.0R | 175.3 P[2] |
| Oct 1982 | 377.2P | — |

P = Preliminary R = Revised since last month

[1] Australian Bureau of Statistics, Canberra: "Price Index of Materials Used in Manufacturing Industry" (Catalogue No. 6411.0), Table 3.

[2] Australian Bureau of Statistics, Canberra: "Wage Rates, Australia" (Catalogue No. 6312.0), Table 1. Figures are being converted to an Index number. As the data are converted, the new index numbers will be inserted.

[3] Monthly data for 1970 through 1978 appear on pages 4.7 and 4.8 of Nuexco Report 138.

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*GOVERNMENT STATISTICS*

## CANADA

| | Industry Selling Price Index: Manufacturing (D 500000)[1] [2] (1971 = 100.0) | Wage-earner Data: Average Hourly Earnings (C$)[3] [4] | | |
|---|---|---|---|---|
| | | Metal Mining, including Milling (SIC 050-059) | Primary Metal Industries, non-ferrous (SIC 296-298) | Chemicals and Chemical Products (SIC 370-379) |
| Annual Avg. 1978 | 190.4 | 8.76 | 6.82 | 6.97 |
| Annual Avg. 1979 | 217.9 | 9.60 | 7.35 | 7.67 |
| Annual Avg. 1980 | 247.2 | 10.59 | 8.05 | 8.50 |
| Annual Avg. 1981 | 272.3P | 12.02 | 9.03 | 9.53 |
| Oct 1981 | 279.3 | 12.78 | 9.35 | 9.91 |
| Nov 1981 | 278.8 | 12.89 | 9.45 | 9.89 |
| Dec 1981 | 280.0 | 12.87 | 9.42 | 10.03 |
| Jan 1982 | 281.9 | 13.14 | 9.53 | 10.11 |
| Feb 1982 | 283.5 | 13.25 | 9.60 | 10.19 |
| Mar 1982 | 284.8 | 13.34 | 9.62 | 10.35 |
| Apr 1982 | 287.7R | 13.46 | 9.79 | 10.48 |
| May 1982 | 288.8R | 13.56 | 9.88 | 10.62 |
| Jun 1982 | 289.7R | 13.71 | 9.92 | 10.69 |
| Jul 1982 | 290.3R | 13.71R | 10.05 | 10.73R |
| Aug 1982 | 290.0R | 13.88R | 10.01R | 10.78R |
| Sep 1982 | 292.3R | 13.92P | 10.23P | 10.68P |
| Oct 1982 | 291.8 | — | — | — |

P = Preliminary    R = Revised since last month

[1] Statistics Canada, Prices Division, Ottawa; "Industry Price Indexes" (Catalogue 62-011), Table 1. Indexes for the most recent six months shown are subject to revision.

[2] Monthly data for 1973 through 1978 appear on page 4.10 of Nuexco Report 138.

[3] Statistics Canada, Labour Division, Employment and Payrolls Section, Ottawa; "Employment, Earnings and Hours" (Catalogue 72-002), Table 2.

[4] Monthly data for 1977 and 1978 appear on page 4.11 of Nuexco Report 138.

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## REPUBLIC OF SOUTH AFRICA

| | Average Declared Working Costs per Metric Ton of Gold Ore Milled (Rand)[1] | Consumer Price Index[2] (1975 = 100, except where otherwise indicated) | Producer[5] Price Index All Groups (1975 = 100) | Total Employment in Mining and Quarrying (Code 35)[7] | Total Salaries and Wages in Mining and Quarrying (1,000 Rand) (Code 40)[7] |
|---|---|---|---|---|---|
| Annual Avg. 1971[3] | 7.88 | 106.4[4] | 59.1 | 652,294 | 415,956 |
| Annual Avg. 1972[3] | 8.79 | 113.3[4] | 63.9 | 623,067 | 443,933 |
| Annual Avg. 1973[3] | 10.51 | 124.1[4] | 72.3 | 684,743 | 572,133 |
| Annual Avg. 1974[3] | 13.18 | 138.5[4] | 85.3 | 674,140 | 761,596 |
| Annual Avg. 1975[3] | 16.71 | 157.2[4] | 100.0 | 639,473 | 1,003,617 |
| Annual Avg. 1976[3] | 19.30 | 174.7[4] | 115.1 | 671,240 | 1,212,983 |
| Annual Avg. 1977[3] [6] | 23.87 | 194.4[4] | 130.0 | 712,006 | 1,420,670 |
| Annual Avg. 1978[3] [6] | 27.14 | 137.2 | 142.7 | 664,571 | 1,537,169 |
| Annual Avg. 1979[3] [6] | 30.18 | 155.3 | 164.5 | 692,209 | 1,830,632 |
| Annual Avg. 1980[6] | 35.53 | 176.7 | 192.1 | 714,379 | 2,279,615 |
| Annual Avg. 1981 | 41.89 | 206.5R | 218.3 | 728,506 | 2,820,505 |
| May 1981 | — | 197.7 | 213.2 | 726,869 | 219,880 |
| Jun 1981 | 40.41 | 200.0 | 215.3 | 728,506 | 237,049 |
| Jul 1981 | — | 204.6 | 218.4 | 735,839 | 249,080 |
| Aug 1981 | — | 208.0 | 222.6 | 722,684 | 245,817 |
| Sep 1981 | 43.28 | 211.6 | 224.6 | 724,604 | 251,502 |
| Oct 1981 | — | 213.4 | 227.0 | 717,918 | 248,159 |
| Nov 1981 | — | 214.8 | 229.4 | 720,255 | 253,044 |
| Dec 1981 | 44.52 | 216.3 | 230.4 | 709,612 | 257,655 |
| Jan 1982 | — | 217.6 | 233.1 | 700,375 | 257,173 |
| Feb 1982 | — | 220.2 | 236.8 | 705,992 | 250,191 |
| Mar 1982 | 45.49 | 225.2 | 237.4 | 725,700 | 262,210 |
| Apr 1982 | — | 228.9 | 241.9 | 707,502 | 252,562 |
| May 1982 | — | 230.3 | 244.8 | 715,162 | 258,770 |
| Jun 1982 | 45.77 | 232.1 | 246.7 | 707,552 | 261,361 |
| Jul 1982 | — | 234.1 | 249.4 | 702,141 | 283,248 |
| Aug 1982 | — | 236.8 | 253.4 | 705,562 | 276,730 |
| Sep 1982 | 48.04 | 241.0 | 255.0 | 704,490 | 281,331 |
| Oct 1982 | — | 243.9 | 260.1 | — | — |

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[1] Chamber of Mines of South Africa, Johannesburg; "Analysis of Working Results," published quarterly.
[2] Republic of South Africa Department of Statistics, Pretoria; "Government Gazette: Consumer Price Index for Urban Areas."
[3] Historical data for the Average Declared Working Costs and Consumer Price Index 1970-1979 appear on page 4.9 of Nuexco Report 140.
[4] April 1970 = 100.00.
[5] Previously known as the WHOLESALE PRICE INDEX, now the PRODUCER PRICE INDEX. The computation remains the same.
[6] Historical data for Codes 35 and 40 1977-1980 appear on page 28 of Nuexco Report 157.
[7] Bulletin of Statistics, Department of Statistics, Pretoria.

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*GOVERNMENT STATISTICS*

## UNITED STATES

| | Producer Price Index— Industrial Commodities (1967 = 100)[1] | Producer Price Index— All Commodities (1967 = 100)[1] | Consumer Price Index (1967 = 100)[2] | GNP Implicit Price Deflator (1972 = 100)[3] | Gross Average Hourly Earnings of Production or Non-supervisory Workers (US$)[4] | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Metal Mining (SIC 10) | Primary Non-ferrous Metals (SIC 333) | Chemicals and Allied Products (SIC 28) | Electric and Electronic Equipment (SIC 36) |
| Annual Avg. 1971[5] | 114.1 | 114.0 | 121.3 | 96.01 | 4.12 | 4.15 | 3.97 | 3.49 |
| Annual Avg. 1972[5] | 117.9 | 119.1 | 125.3 | 100.00 | 4.56 | 4.59 | 4.26 | 3.71 |
| Annual Avg. 1973[5] | 125.9 | 134.7 | 133.1 | 105.75 | 4.84 | 4.98 | 4.51 | 3.91 |
| Annual Avg. 1974[5] | 153.8 | 160.1 | 147.7 | 115.08 | 5.44 | 5.63 | 4.88 | 4.21 |
| Annual Avg. 1975[5] | 171.5 | 174.9 | 161.2 | 125.79 | 6.13 | 6.24 | 5.39 | 4.64 |
| Annual Avg. 1976[5] | 182.4 | 183.0 | 170.5 | 132.34 | 6.76 | 6.87 | 5.91 | 4.96 |
| Annual Avg. 1977[5] | 195.1 | 194.2 | 181.5 | 140.05 | 7.28 | 7.67 | 6.43 | 5.39 |
| Annual Avg. 1978[5] | 209.4 | 209.3 | 195.4 | 150.42 | 8.23 | 8.56 | 7.02 | 5.82 |
| Annual Avg. 1979[5] | 236.5 | 235.6 | 217.4 | 163.42 | 9.27 | 9.50 | 7.60 | 6.32 |
| Annual Avg. 1980[5] | 274.8 | 268.8 | 246.8 | 178.64 | 10.26 | 10.63 | 8.30 | 6.94 |
| Annual Avg. 1981 | 304.1 | 293.4 | 272.4 | 195.51 | 11.55 | 11.98 | 9.12 | 7.62 |
| Nov 1981 | 309.3 | 295.5 | 280.7 | — | 12.12 | 12.48 | 9.42 | 7.83 |
| Dec 1981 | 310.0 | 295.8 | 281.5 | 201.55 | 12.08 | 12.45 | 9.53 | 7.90 |
| Jan 1982 | 311.7 | 298.2 | 282.5 | — | 12.19 | 12.66 | 9.68 | 7.98 |
| Feb 1982 | 311.4 | 298.5 | 283.4 | — | 12.22 | 12.61 | 9.68 | 7.96 |
| Mar 1982 | 311.0 | 298.0 | 283.1 | 203.68 | 12.29 | 12.69 | 9.71 | 8.01 |
| Apr 1982 | 309.9 | 298.0 | 284.3 | — | 12.23 | 12.68 | 9.81 | 8.03 |
| May 1982 | 309.6 | 298.6 | 287.1 | — | 12.25 | 12.71 | 9.83 | 8.05 |
| Jun 1982 | 310.6 | 299.3 | 290.6 | 205.98 | 12.26 | 12.91 | 9.95 | 8.09 |
| Jul 1982 | 312.8R | 300.4R | 292.2 | — | 12.23 | 12.91 | 10.02 | 8.18 |
| Aug 1982 | 313.4P | 300.4P | 292.8 | — | 12.29 | 12.97 | 10.03 | 8.24 |
| Sep 1982 | 312.9P | 299.5P | 293.3 | 208.51R | 12.53R | 13.46R | 10.20R | 8.31R |
| Oct 1982 | 314.4P | 299.9P | 294.1 | — | 12.45P | 13.24P | 10.24R | 8.34R |
| Nov 1982 | 315.1P | 300.4P | 293.6 | — | — | — | 10.25P | 8.39P |

P = Preliminary R = Revised since last month

[1] US Bureau of Labor Statistics, Washington, D.C.; "Producer Prices and Price Indexes," Table 6 (formerly "Wholesale Prices and Price Indexes"). Producer Price Indexes are revised four months after they are first released to reflect the availability of late reports and corrections by respondents.

[2] US Bureau of Labor Statistics, Washington, D.C.; Consumer Price Index for All Urban Consumers, US City Average, All Items.

[3] US Department of Commerce, Washington, D.C.; Bureau of Economic Analysis, National Income and Wealth Division; "Survey of Current Business," Table A. The GNP Implicit Price Deflator is published quarterly, and seasonally adjusted.

[4] US Bureau of Labor Statistics, Washington, D.C.; "Employment and Earnings," Table C-2. All data based on 1972 revision of SIC Manual. Data for 1970-1976 are adjusted to the March 1977 benchmark. Data for 1977-1978 are adjusted to the March 1979 benchmark. Data for January 1979 and beyond are adjusted to the March 1980 benchmark.

[5] Monthly data 1970-1978 for Producer Price Index-Industrial Commodities, Consumer Price Index, and Employment and Earnings SIC codes 10, 333, and 28, and quarterly data for GNP Implicit Price Deflator appear on pages 4.6-4.8 of Nuexco Report 139.
Monthly data 1977-1978 for Employment and Earnings SIC Codes 10, 333, and 28 appear on page 33 of Nuexco Report 147.
Monthly data 1970-1978 for Employment and Earnings SIC Code 36 appear on page 23 of Nuexco Report 154.
Monthly data 1979-1980 for Employment and Earnings, Revised Establishment Data, all listed codes, appear on page 22 of Nuexco Report 158.
Monthly data 1977-1980 for Producer Price Index-All Commodities, appear on page 21 of Nuexco Report 158.

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## Table 18A

## COST OF ENRICHED URANIUM (US $ per KgU as $UF_6$, 3 percent $U_{235}$) FOR VARIOUS COMBINATIONS OF FEED AND SWU COSTS (0.20% TA)

| Feed Cost (US $ per KgU as Natural $UF_6$) | SWU Price (US $ per SWU) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 90 | 95 | 100 | 105 | 110 | 115 | 120 | 125 | 130 |
| 40 | 606.75 | 628.29 | 649.82 | 671.35 | 692.88 | 714.42 | 735.95 | 757.48 | 779.01 |
| 45 | 634.15 | 655.68 | 677.22 | 698.75 | 720.28 | 741.81 | 763.35 | 784.88 | 806.41 |
| 50 | 661.55 | 683.08 | 704.61 | 726.15 | 747.68 | 769.21 | 790.74 | 812.28 | 833.81 |
| 55 | 688.95 | 710.48 | 732.01 | 753.54 | 775.08 | 796.61 | 818.14 | 839.67 | 861.20 |
| 60 | 716.34 | 737.88 | 759.41 | 780.94 | 802.47 | 824.01 | 845.54 | 867.07 | 888.60 |
| 65 | 743.74 | 765.27 | 786.81 | 808.34 | 829.87 | 851.40 | 872.93 | 894.47 | 916.00 |
| 70 | 771.14 | 792.67 | 814.20 | 835.73 | 857.27 | 878.80 | 900.33 | 921.86 | 943.40 |
| 75 | 798.53 | 820.07 | 841.60 | 863.13 | 884.66 | 906.20 | 927.73 | 949.26 | 970.79 |
| 80 | 825.93 | 847.46 | 869.00 | 890.53 | 912.06 | 933.59 | 955.13 | 976.66 | 998.19 |
| 85 | 853.33 | 874.86 | 896.39 | 917.93 | 939.46 | 960.99 | 982.52 | 1,004.06 | 1,025.59 |
| 90 | 880.73 | 902.26 | 923.79 | 945.32 | 966.86 | 988.39 | 1,009.92 | 1,031.45 | 1,052.99 |
| 95 | 908.12 | 929.66 | 951.19 | 972.72 | 994.25 | 1,015.79 | 1,037.32 | 1,058.85 | 1,080.38 |
| 100 | 935.52 | 957.05 | 978.59 | 1,000.12 | 1,021.65 | 1,043.18 | 1,064.72 | 1,086.25 | 1,107.78 |
| | 90 | 95 | 100 | 105 | 110 | 115 | 120 | 125 | 130 |
| 105 | 962.92 | 984.45 | 1,005.98 | 1,027.52 | 1,049.05 | 1,070.58 | 1,092.11 | 1,113.65 | 1,135.18 |
| 110 | 990.32 | 1,011.85 | 1,033.38 | 1,054.91 | 1,076.45 | 1,097.98 | 1,119.51 | 1,141.04 | 1,162.57 |
| 115 | 1,017.71 | 1,039.25 | 1,060.78 | 1,082.31 | 1,103.84 | 1,125.37 | 1,146.91 | 1,168.44 | 1,189.97 |
| 120 | 1,045.11 | 1,066.64 | 1,088.18 | 1,109.71 | 1,131.24 | 1,152.77 | 1,174.30 | 1,195.84 | 1,217.37 |
| 125 | 1,072.51 | 1,094.04 | 1,115.57 | 1,137.10 | 1,158.64 | 1,180.17 | 1,201.70 | 1,223.23 | 1,244.77 |
| 130 | 1,099.90 | 1,121.44 | 1,142.97 | 1,164.50 | 1,186.03 | 1,207.57 | 1,229.10 | 1,250.63 | 1,272.16 |
| 135 | 1,127.30 | 1,148.83 | 1,170.37 | 1,191.90 | 1,213.43 | 1,234.96 | 1,256.50 | 1,278.03 | 1,299.56 |
| 140 | 1,154.70 | 1,176.23 | 1,197.76 | 1,219.30 | 1,240.83 | 1,262.36 | 1,283.89 | 1,305.43 | 1,326.96 |
| 145 | 1,182.10 | 1,203.63 | 1,225.16 | 1,246.69 | 1,268.23 | 1,289.76 | 1,311.29 | 1,332.82 | 1,354.36 |
| 150 | 1,209.49 | 1,231.03 | 1,252.56 | 1,274.09 | 1,295.62 | 1,317.16 | 1,338.69 | 1,360.22 | 1,381.75 |
| 155 | 1,236.89 | 1,258.42 | 1,279.96 | 1,301.49 | 1,323.02 | 1,344.55 | 1,366.09 | 1,387.62 | 1,409.15 |
| 160 | 1,264.29 | 1,285.82 | 1,307.35 | 1,328.89 | 1,350.42 | 1,371.95 | 1,393.48 | 1,415.02 | 1,436.55 |

## OPTIMUM TAILS ASSAY FOR VARIOUS COMBINATIONS OF FEED AND SWU COSTS

(percent $U_{235}$)

| Feed Cost (US$ per KgU as Natural $UF_6$) | SWU Price (US $ per SWU) | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 90 | 95 | 100 | 105 | 110 | 115 | 120 | 125 | 130 | 138.65 | 140 | 149.85 | 160 | 170 | 180 | 190 | 200 |
| 40 | .316 | .322 | .327 | .333 | .338 | .343 | .347 | .352 | .356 | .363 | .364 | .372 | .379 | .385 | .391 | .397 | .402 |
| 45 | .302 | .308 | .314 | .320 | .325 | .330 | .334 | .339 | .343 | .350 | .351 | .359 | .366 | .373 | .379 | .384 | .390 |
| 50 | .291 | .297 | .302 | .308 | .313 | .318 | .323 | .327 | .332 | .339 | .340 | .347 | .354 | .361 | .367 | .373 | .379 |
| 55 | .280 | .286 | .292 | .297 | .302 | .307 | .312 | .317 | .321 | .328 | .329 | .337 | .344 | .351 | .357 | .363 | .368 |
| 60 | .271 | .277 | .282 | .288 | .293 | .298 | .302 | .307 | .311 | .319 | .320 | .327 | .334 | .341 | .347 | .353 | .359 |
| 65 | .262 | .268 | .273 | .279 | .284 | .289 | .294 | .298 | .302 | .310 | .311 | .318 | .326 | .332 | .339 | .345 | .350 |
| 70 | .254 | .260 | .265 | .271 | .276 | .281 | .285 | .290 | .294 | .301 | .302 | .310 | .317 | .324 | .330 | .336 | .342 |
| 75 | .246 | .252 | .258 | .263 | .268 | .273 | .278 | .282 | .287 | .294 | .295 | .302 | .310 | .316 | .323 | .329 | .334 |
| 80 | .239 | .245 | .251 | .256 | .261 | .266 | .271 | .275 | .279 | .287 | .288 | .295 | .302 | .309 | .316 | .322 | .327 |
| 85 | .233 | .239 | .244 | .249 | .254 | .259 | .264 | .268 | .273 | .280 | .281 | .288 | .296 | .302 | .309 | .315 | .321 |
| 90 | .227 | .232 | .238 | .243 | .248 | .253 | .258 | .262 | .266 | .274 | .275 | .282 | .289 | .296 | .302 | .308 | .314 |
| 95 | .221 | .227 | .232 | .237 | .242 | .247 | .252 | .256 | .260 | .268 | .269 | .276 | .283 | .290 | .296 | .302 | .308 |
| 100 | .216 | .221 | .227 | .232 | .237 | .242 | .246 | .251 | .255 | .262 | .263 | .270 | .278 | .284 | .291 | .297 | .302 |

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## Table 18B

## COST OF ENRICHED URANIUM (US $ per KgU as UF$_6$, 3 percent U$_{235}$) FOR VARIOUS COMBINATIONS OF FEED AND SWU COSTS (0.20% TA)

| Feed Cost (US $ per KgU as Natural UF$_6$) | SWU Price (US $ per SWU) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 138.65 | 140 | 149.85 | 160 | 170 | 180 | 190 | 200 |
| 40 | 816.26 | 822.08 | 864.50 | 908.21 | 951.27 | 994.34 | 1,037.40 | 1,080.47 |
| 45 | 843.66 | 849.48 | 891.89 | 935.60 | 978.67 | 1,021.73 | 1,064.80 | 1,107.86 |
| 50 | 871.06 | 876.87 | 919.29 | 963.00 | 1,006.07 | 1,049.13 | 1,092.20 | 1,135.26 |
| 55 | 898.46 | 904.27 | 946.69 | 990.40 | 1,033.46 | 1,076.53 | 1,119.59 | 1,162.66 |
| 60 | 925.85 | 931.67 | 974.09 | 1,017.80 | 1,060.86 | 1,103.93 | 1,146.99 | 1,190.06 |
| 65 | 953.25 | 959.06 | 1,001.48 | 1,045.19 | 1,088.26 | 1,131.32 | 1,174.39 | 1,217.45 |
| 70 | 980.65 | 986.46 | 1,028.88 | 1,072.59 | 1,115.66 | 1,158.72 | 1,201.79 | 1,244.85 |
| 75 | 1,008.84 | 1,013.86 | 1,056.28 | 1,099.99 | 1,143.05 | 1,186.12 | 1,229.18 | 1,272.25 |
| 80 | 1,035.44 | 1,041.26 | 1,083.67 | 1,127.39 | 1,170.45 | 1,213.51 | 1,256.58 | 1,299.64 |
| 85 | 1,062.84 | 1,068.65 | 1,111.07 | 1,154.78 | 1,197.85 | 1,240.91 | 1,283.98 | 1,327.04 |
| 90 | 1,090.24 | 1,096.05 | 1,138.47 | 1,182.18 | 1,225.24 | 1,268.31 | 1,311.37 | 1,354.44 |
| 95 | 1,117.63 | 1,123.45 | 1,165.87 | 1,209.58 | 1,252.64 | 1,295.71 | 1,338.77 | 1,381.84 |
| 100 | 1,145.03 | 1,150.85 | 1,193.26 | 1,236.97 | 1,280.04 | 1,323.10 | 1,366.17 | 1,409.23 |

| | 138.65 | 140 | 149.85 | 160 | 170 | 180 | 190 | 200 |
|---|---|---|---|---|---|---|---|---|
| 105 | 1,172.43 | 1,178.24 | 1,220.66 | 1,264.37 | 1,307.44 | 1,350.50 | 1,393.57 | 1,436.63 |
| 110 | 1,199.83 | 1,205.64 | 1,248.06 | 1,291.77 | 1,334.83 | 1,377.90 | 1,420.96 | 1,464.03 |
| 115 | 1,227.22 | 1,233.04 | 1,275.46 | 1,319.17 | 1,362.23 | 1,405.30 | 1,448.36 | 1,491.43 |
| 120 | 1,254.62 | 1,260.43 | 1,302.85 | 1,346.56 | 1,389.63 | 1,432.69 | 1,475.76 | 1,518.82 |
| 125 | 1,282.02 | 1,287.83 | 1,330.25 | 1,373.96 | 1,417.03 | 1,460.09 | 1,503.16 | 1,546.22 |
| 130 | 1,309.41 | 1,315.23 | 1,357.65 | 1,401.36 | 1,444.42 | 1,487.49 | 1,530.55 | 1,573.62 |
| 135 | 1,336.81 | 1,342.63 | 1,385.04 | 1,428.76 | 1,471.82 | 1,514.88 | 1,557.95 | 1,601.01 |
| 140 | 1,364.21 | 1,370.02 | 1,412.44 | 1,456.15 | 1,499.22 | 1,542.28 | 1,585.35 | 1,628.41 |
| 145 | 1,391.61 | 1,397.42 | 1,439.84 | 1,483.55 | 1,526.61 | 1,569.68 | 1,612.74 | 1,655.81 |
| 150 | 1,419.00 | 1,424.82 | 1,467.24 | 1,510.95 | 1,554.01 | 1,597.08 | 1,640.14 | 1,683.21 |
| 155 | 1,446.40 | 1,452.21 | 1,494.63 | 1,538.34 | 1,581.41 | 1,624.47 | 1,667.54 | 1,710.60 |
| 160 | 1,473.80 | 1,479.61 | 1,522.03 | 1,565.74 | 1,608.81 | 1,651.87 | 1,694.94 | 1,738.00 |

## OPTIMUM TAILS ASSAY FOR VARIOUS COMBINATIONS OF FEED AND SWU COSTS

(percent U$_{235}$)

| Feed Cost (US$ per KgU as Natural UF$_6$) | SWU Price (US $ per SWU) | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 90 | 95 | 100 | 105 | 110 | 115 | 120 | 125 | 130 | 138.65 | 140 | 149.85 | 160 | 170 | 180 | 190 | 200 |
| 105 | .211 | .216 | .222 | .227 | .232 | .236 | .241 | .245 | .250 | .257 | .258 | .265 | .272 | .279 | .285 | .291 | .297 |
| 110 | .206 | .211 | .217 | .222 | .227 | .231 | .236 | .240 | .245 | .252 | .253 | .260 | .267 | .274 | .280 | .286 | .292 |
| 115 | .201 | .207 | .212 | .217 | .222 | .227 | .231 | .236 | .240 | .247 | .248 | .255 | .262 | .269 | .275 | .281 | .287 |
| 120 | .197 | .202 | .208 | .213 | .218 | .222 | .227 | .231 | .235 | .242 | .243 | .250 | .258 | .264 | .271 | .277 | .282 |
| 125 | .193 | .198 | .204 | .209 | .213 | .218 | .222 | .227 | .231 | .238 | .239 | .246 | .253 | .260 | .266 | .272 | .278 |
| 130 | .189 | .194 | .200 | .205 | .209 | .214 | .218 | .223 | .227 | .234 | .235 | .242 | .249 | .256 | .262 | .268 | .273 |
| 135 | .185 | .191 | .196 | .201 | .205 | .210 | .214 | .219 | .223 | .230 | .231 | .238 | .245 | .251 | .258 | .264 | .269 |
| 140 | .182 | .187 | .192 | .197 | .202 | .206 | .211 | .215 | .219 | .226 | .227 | .234 | .241 | .247 | .254 | .260 | .265 |
| 145 | .178 | .184 | .189 | .194 | .198 | .203 | .207 | .211 | .215 | .222 | .223 | .230 | .237 | .244 | .250 | .256 | .261 |
| 150 | .175 | .180 | .185 | .190 | .195 | .199 | .204 | .208 | .212 | .218 | .219 | .227 | .234 | .240 | .246 | .252 | .258 |
| 155 | .172 | .177 | .182 | .187 | .192 | .196 | .200 | .204 | .208 | .215 | .216 | .223 | .230 | .237 | .243 | .248 | .254 |
| 160 | .169 | .174 | .179 | .184 | .188 | .193 | .197 | .201 | .205 | .212 | .213 | .220 | .227 | .233 | .239 | .245 | .251 |

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FEBRUARY 1983 NUMBER 174

# Monthly Report on the Nuclear Fuel Market

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MONTHLY REPORT ON THE URANIUM MARKET

February 1983 No. 174

R. WESLEY MILLER, *EDITOR*

*PRICING*

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*FOREWORD*

Nuexco is pleased to announce the establishment of our Atlanta office and the transfer of Jerry Reaves, Vice President, to Atlanta.

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*PRICING*

## NATURAL URANIUM AND CONVERSION

The **Exchange Value** as of January 31, 1983 rose for the fourth consecutive month, to **$21.50** per pound $U_3O_8$, up $1.25 since last month. The sustained buying activity of the past six months diminished somewhat, to levels more familiar to followers of the spot and near-term markets. The *Current Market Data* section lists five uranium sales, containing a total of approximately 2.5 million pounds $U_3O_8$, *equivalent*. Two of the transactions involved uranium concentrates ($U_3O_8$), two involved natural uranium hexafluoride ($UF_6$), and one involved enriched $UF_6$.

* * *

**Active spot and near-term supply** of uranium (material offered at competitive prices, terms and other conditions) amounts to **9.4** million pounds $U_3O_8$, equivalent, up 7 percent from last month's level of 8.8 million. **Active spot and near-term demand** rose to **4.7** million pounds $U_3O_8$ equivalent, up 20 percent from last month. Therefore, the spot and near-term **supply-demand ratio** dropped slightly, to **2.0:1**.

* * *

The **Transaction Value** as of January 31, 1983 is **$19.35** per pound $U_3O_8$, up $0.55 from a month ago. The current Transaction Value includes 12 transactions involving a total of 5.4 million pounds $U_3O_8$ equivalent, and covers a period of three months.

* * *

The **Conversion Value** as of January 31, 1983 is **$1.20** per pound U as $UF_6$, down $0.25 from last month. **Active inquiries to sell** conversion services within one year total **3.3 million** pounds U, up approximately 25 percent since last month. **Active inquiries to buy** conversion services within one year held at last month's level of **220 thousand** pounds U as $UF_6$. There are no conversion transactions reported this month. A total of 10-15 million pounds of conversion services could become available in the coming months from six sources located both in Europe and the US. If fierce competition develops among these potential sellers for the extremely limited opportunities for secondary market conversion services, the Conversion Value could be subject to drastic swings in either direction.

* * *

The **Loan Use Charge Rate** remained at six percent per annum. The limited activity in the market is taking place at or near that level, but there are few participants.

* * *

The convergence of a number of different factors both individually and in combination has led to a complex situation in the spot and near-term uranium markets. These factors include:

1. Form of the uranium;
2. National origin of the uranium;
3. Physical location of the uranium;
4. Specifications of the uranium;
5. Size of the lots offered or sought;
6. Credibility of the buyers and sellers.

While none of these factors is new to the marketplace, it is unusual to have all of them present and interacting simultaneously. Thus, depending on the given situation, the influence of one or more of these factors may result in prices being paid which are higher or lower than the Exchange Value.

Recently, the simultaneous interaction of these factors has resulted in wider price distributions than have been typical. Under such circumstances, the Exchange Value will be in the range of this distribution. Premiums may be evident when a buyer requires specific tonnage, specific nationality, specific delivery date, specific delivery location, or category of seller, or some combination of the above. Similarly, discounts may be evident if quantity, form, nationality, delivery date or location is other than what is optimally desired. It is important to recall that the definition of Exchange Value presumes no particulars other than *uranium concentrates*. Thus, uranium in the form of natural or enriched $UF_6$ may command a premium or require a discount depending on individual circumstances and the values imputed to the conversion and enrichment components. And the disparity between such values imputed by buyer and seller, one buyer versus another or one seller versus another, can account for wide variations in perceived $U_3O_8$ price. Similar considerations apply to national origin, location, size and other variables.

## ENRICHED URANIUM AND SWUs

### January 1983

Although a number of 3.5-year DOE Requirements contract holders are seeking secondary market supplies for FY 1983, Nuexco is not presently aware of any DOE

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sellers willing to offer prices low enough to make contract terminations attractive. There are, however, large quantities of Eurodif SWU being offered at discounts of approximately $35 from DOE's AFC price. The prevailing discount for DOE FY 1983 SWU remains at approximately $25 from the AFC price. Sellers of DOE SWU for delivery in FY 84 continue to offer discounts of $28-$30 from DOE's AFC price (at .2 tails). The market for DOE SWU for FY 1985 and later has virtually disappeared while potential sellers await DOE's announcement of the terms and conditions of conversion to the FR contract.

## 1982 ANNUAL REVIEW

### Introduction

The secondary market for enrichment services has undergone a fundamental change during the past one to two years. From a limited market characterized by assignments of Fixed-Commitment contracts from one US DOE customer to another, it has begun to develop into a truly worldwide secondary market. During 1982, utilities began making use of the secondary SWU market as an integral part of their overall fuel procurement strategy, much as they have been using the spot uranium and conversion markets. Many have expressed hope that the secondary market remains active for the long term.

Many of the factors driving this market are the same as those driving the $U_3O_8$ and conversion markets. Overoptimistic demand projections, contracting far in advance of need, reactor cancellations and deferrals, supply overcapacity, inventory accumulation, and high carrying costs combined to produce in many market participants—utilities, in this case—a strong desire to sell their excess inventories. This article will review how the secondary SWU market developed to this point, and comment on how this new market may be affected by future events.

### Early Development of the Secondary SWU Market

It was the introduction of the AFC contract combined with DOE's reopening of the order books that first created an active secondary SWU market. DOE chose to provide contract relief to customers through liberalized schedule adjustment provisions when LTFC contracts were converted to the AFC form under the July 1, 1978 option. Some DOE Fixed-Commitment customers suddenly found themselves able to seek new supply for years when others less fortunate were still stuck with excess commitments. DOE's policy allowing customers to reduce the amount of SWUs taken directly from DOE by the same amount of DOE SWU obtained on the secondary market was used extensively to the apparent advantage of both buyers and sellers as new schedules of commitments were drawn up. As reactor cancellations and deferrals increased the excess of SWU supply, new demand entered the market with the signing of new DOE contracts. Thus, some of the new contracts could be partially filled by assignments of other utilities' excess SWU.

The discounts available for secondary market transactions (assignments from one holder of a US DOE fixed-commitment contract to another) during the 1978-1979 time period were in the range of $2 to $5 per SWU for all fiscal years. This would seem to indicate that the market supply and demand were approximately in balance. However, the level of discounts was misleading. The market was in its infancy, there was little market information available, and the level of sophistication among market participants was low. Almost all accepted the transactions that were brought to them without argument, apparently feeling that they would be unable to complete the required contracting and interface with DOE without outside assistance.

As the market has developed, market participants' increasing sophistication and the better information produced by open competition in the marketplace have reinforced one another. Discounts have become more representative of market factors, such as the amount of DOE termination charges and the balance of supply and demand, instead of being determined arbitrarily in the absence of adequate information.

The Variable Tails Assay Option (VTAO) also facilitated the development of the secondary SWU market. Falling $U_3O_8$ prices made the higher tails assays available under the VTAO more valuable than the 0.20 percent tails assays mandated under Requirements contracts. Nuexco's analysis of the VTAO's effect on the secondary SWU market, published in Report 171, is reprinted immediately following this article.

The first signs of the factors which would be responsible for the sweeping changes in this market environment became evident by the beginning of 1980. By that time, most schedule adjustments and conversions to AFC contracts had already been completed. As the market for new reactor orders had virtually ground to a halt, very few new enrichment contracts were being

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signed. Thus, the demand for short-term SWU dropped dramatically and the primary customers for assignments of US DOE AFC SWUs withdrew from the market.

In order to stimulate new demand, sellers increased the discounts they were offering. At the same time, the continual reactor construction delays fed more and more new short-term supply into the market. A number of short-term sellers, frustrated in their attempts to sell, eventually began actively soliciting buyers. A few short-term *buyers* who had become sophisticated enough to perceive their market advantage decided to seek supply through open bidding.

Those buyers were able to obtain discounts of more than $20 per SWU through such open bidding. These transactions were widely reported, and other buyers began demanding and receiving similar discounts. Since then, open bidding by buyers and sellers has become the rule on the secondary SWU markets, just as in the uranium and conversion markets.

Still, through 1980, the secondary SWU market was characterized almost completely by sales from one DOE fixed-commitment customer to another. It was far from a true spot market. During that period, standard utility practice called for buyers to automatically contract well in advance with DOE for enrichment services sufficient for the entire life of a planned project. Most buyers looked on the secondary market only as a tool to assist them with that function.

Many buyers soon found themselves reentering the market as sellers due to their having bought new long-term commitments on the secondary market for reactors that were soon thereafter delayed further or cancelled. Although contract assignments had helped to relieve the SWU supply-demand imbalance *temporarily*, the continuation of apparently conservative purchasing practices had caused the SWU supply-demand imbalance to worsen in the *long term*.

## Development of the Market During 1981-1982

Continued reactor delays aggravated the short-term oversupply of SWU on the secondary market. The more open exchange of information in the secondary market enabled it to respond in classic fashion—prices dropped, in the form of discounts greater than $30 per SWU from DOE's AFC price. During 1981, the discounts reached a level that made it profitable for certain DOE customers (holders of DOE requirements contracts having 3.5-year termination provisions) to terminate both short-term and long-term commitments and buy replacement DOE Fixed Commitment SWU on the secondary market.

At first, buyers were only willing to terminate after they had already found replacement SWU on the secondary market. Some buyers would try to terminate only a current delivery, in effect terminating their requirements contracts on a year-to-year basis for a relatively small monetary gain. Other buyers terminated long term, in effect choosing to exchange the flexibility of the requirements contract for the increased savings made available by the fact that DOE termination charges decrease with time. Several distinct stages of market development were evident:

1. Near the end of 1981 and continuing into 1982, some of DOE's *overseas* customers holding requirements contracts with 3.5 year termination provisions began terminating some of their SWU requirements scheduled for delivery 18 to 24 months later and replacing them with attractively discounted SWUs from other sources, such as Eurodif or Techsnabexport.
2. Later in the year, some of DOE's *US* customers holding requirements contracts having 3.5 year termination provisions began terminating some of their SWU requirements scheduled for delivery 18 to 24 months later and replacing them with SWU from LTFC or AFC contracts. In both this case and the previous one, sellers terminating their DOE SWU contracts acted simultaneously to effect any necessary replacement, so as to accept zero risk of supply.
3. The next phase in the development of the secondary SWU market saw both US and overseas DOE customers holding requirements with 3.5 year termination provisions begin terminating their DOE commitments with very short notice, 6-12 months, and replacing them with highly discounted AFC SWUs from any other DOE customer. As sellers of excess AFC SWUs had filled demand from potential buyers who were willing to terminate their requirements contracts with relatively long notice periods, and the correspondingly modest termination charges, the selling had become more difficult. In order to stimulate more demand, those same sellers raised discount levels even further. The higher discounts enabled buyers to execute a risk-free transaction and still make a profit, even after paying the higher termination charges associated with short notice.
4. Eventually, however, and importantly for the development of the market, in 1982 a number of US buyers, having done such a transaction once or twice, became willing to terminate DOE requirements contracts long term and intentionally go short. They are

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expecting to contract for replacement SWU only when their actual requirements become known, counting on the secondary market as a later source of supply.

Meanwhile, European buyers' enriched uranium inventories were continuing to increase due to contractual overcommitments to primary suppliers in Europe, which were almost three times actual expected reactor requirements of the customer utilities. European sellers began approaching US DOE customers, but initially with no success. There was still a large amount of DOE SWU available on the market, although at a slightly lower discount, and taking foreign SWU was initially perceived by US utilities to be too great a risk.

By the end of 1982, however, the flood of new requirements contract buyers had used up almost all available DOE secondary market SWU for short-term delivery at high discounts. There was not enough secondary market DOE SWU available to meet the demand of those requirements contract holders who had not yet terminated 1983 deliveries and wished to do so. The attempts to sell Eurodif SWU into the US began to meet with some success. Buyers either had to stay with the requirements contracts, or purchase non-DOE SWU. A number made the decision to purchase foreign SWU.

The new DOE Facility Requirements (FR) contract, introduced during 1982, is the largest uncertainty in the secondary SWU market. Termination charges under the FR have been designed to be prohibitive, so that wholesale conversion to the FR would virtually eliminate US DOE customers as potential buyers of non-DOE secondary market SWUs. However, DOE has not yet announced the terms and conditions of conversion to the FR, such as the range of schedule adjustments which will be allowed and the costs thereof. Those terms and conditions will help shape the future development of the market.

### Future Development of the Market

The secondary SWU market is beginning to be viewed by at least some participants as a true spot market, another tool to be used along with long-term contracting as part of an overall strategy to minimize fuel costs. Whether the market will indeed develop to the point of being widely used for this purpose depends upon SWU supply for the long term remaining available on the secondary market.

Worldwide enrichment capacity will exceed expected reactor requirements far into the future. The critical question is whether this excess capacity will be translated into excess commitments that find their way to the secondary market.

The introduction by DOE of the FR contract constitutes the most serious threat to the long-term continuance of a strong secondary SWU market driven by excess DOE commitments. The FR contract's two-year rolling firm commitment period (as against the AFC contract's five years) indicates that, should most AFC customers convert as expected, the quantity of excess DOE SWU available in the secondary market will diminish drastically. Some excess commitments will continue to exist due to unexpected reactor delays, but customers will not be faced with the possibility of building up years of unneeded inventory for a reactor that has not yet begun to operate. Therefore, the economic incentive to sell on the secondary market as against simply buying and holding inventory will be reduced substantially.

On the other hand, the continued buildup of enriched inventories in Europe, caused by the overcommitments of the various Eurodif partners, strongly implies that a large surplus of non-DOE SWU will become available for sale long term on the secondary market. The vast majority of potential buyers remain the DOE 3.5 year requirements contract holders. The vast majority of these DOE customers are in the United States, so they effectively dominate the buy side of the market. Conversely, European holders of excess SWU will control the sell side of the market.

Whether the secondary SWU market remains active for the long term, as many active buyers hope, or instead proves to be a short-term anomaly, depends primarily on the acceptability of non-DOE SWU to those same US buyers. At present, it appears that most US buyers, while still preferring DOE secondary market supply, would much rather take the perceived risk of buying foreign SWU than give up the economic advantages of participating in the secondary market altogether. The next significant market development could easily be the termination, both with short notice and longer term, of DOE requirements contracts and their replacement with non-DOE SWUs for the longer term.

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## THE VARIABLE TAILS ASSAY OPTION: ITS SIGNIFICANCE TO THE SECONDARY SWU MARKET

Nuexco's brokerage experience indicates that the availability of the VTAO has encouraged the existence of an active secondary market in SWU. The VTAO has had the following commercial effects:

1. It has effectively reduced the economic penalty of selling SWU. Without the VTAO, some utilities having excess SWU commitments would decide simply to hold enriched uranium inventory. Having the option to vary their tails assay, those same utilities now find it economic to sell at the somewhat lower discounts necessary to complete a transaction at a higher tails assay.

2. It has enabled more utilities holding DOE requirements contracts to obtain the effective discounts necessary to economically terminate and buy replacement DOE SWU on the secondary market.

An example will illustrate the use of the VTAO to facilitate a secondary market SWU transaction:

1. Utility A, wishing to dispose of excess SWU commitments, has elected a tails assay for its fiscal year 1983 (FY83) deliveries of 0.28 w/o (weight percent) under the VTAO.

2. Utility B, holding a 3.5 year termination requirements contract, decides to partially terminate its minimum expected requirements for FY83 of 100,000 SWU and buy the replacement SWUs from Utility A. Utility B pays DOE a termination charge of $37.46 for each SWU terminated (25 percent of the requirements contract price, $149.85 per SWU).

3. Utility B, just to break even, must therefore receive an effective SWU price of $112.39 per SWU ($149.85-$37.46).

4. In order to have some incentive to complete the transaction, Utility B decides it needs an additional discount of $3 per SWU, or a price of $109.39.

5. Therefore, if Utility A were selling SWU at a tails assay of 0.20 w/o, Utility A would need to offer a discount of $29.26 off the Adjustable Fixed Commitment (AFC) price per SWU ($138.65-$109.39).

Since Utility A is offering 0.28 w/o tails rather than .2 tails, however, the discount offered will be significantly less than $29.26, depending on the enriched product assay Utility B wants, as well as the marginal cost of $UF_6$ feed. *Note that Utility B's historical cost of feed does not affect the calculation, only the marginal cost of buying additional feed (in place of SWU) on the open market.*

Assuming that Utility B wants an enriched product assay of 3.4 percent, and that the marginal cost of feed in the spot market is $48 per KgU, the discount offered by Utility A could be calculated as follows:

1. Calculate the amount of enriched product Utility B wants, as well as the quantity of SWUs and natural feed required at .2 tails.

100,000 SWU at .2 tails will produce 100,000/5.19 or 19,268 KgU as 3.4 percent enriched $UF_6$, and requires 19,268 × 6.26 or 120,618 KgU as natural $UF_6$ feed.

2. Calculate the quantity of SWUs and feed that would be required at .28 percent tails assay.

19,268 KgU at 3.4 percent enrichment with .28 tails requires 19,268 × 4.32 or 83,238 SWU and 19,268 × 7.24 = 139,500 KgU feed.

3. Calculate the cost of 19,268 KgU at 3.4 percent enrichment with .2 w/o TA.

100,000 SWU × $109.39 per SWU ($138.65-$29.26) + 120,618 KgU feed × feed price ($48 per KgU feed) = $16,728,664.00.

4. In order to calculate the SWU price (SP) at .28 TA that would be equivalent to a discount of $29.26 at .2 TA, set the cost of product at .2 TA equal to the cost of the *same amount* of product (19,268 KgU as $UF_6$) at .28 TA.

5. Thus, at .28 TA, the cost of 19,268 KgU as 3.4 percent enriched $UF_6$ would be calculated as

83,237 SWU × SP in $ per SWU + 139,500 KgU feed × feed price ($48 per KgU feed) = $16,728,664.00.

6. Thus, 83,238 × SP = $10,032,664, so SP = $120.53.

Solving for SP indicates that a price of $120.53 per SWU at .28 tails offered by Utility A will be effectively equivalent to a SWU price of $109.39 at .2 tails. So Utility A only would need to offer a discount of $138.65 – $120.53, or $18.12 per SWU to complete this transaction.

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*CURRENT MARKET DATA*

**EXCHANGE VALUE $21.50/lb. $U_3O_8$**
Determined as of January 31, 1983

**Definition**[1]

The Exchange Value is Nuexco's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the last day of the month.

**Derivation**

Nuexco bases the Exchange Value upon:

A. Data from recently completed transactions.
B. Data from pending transactions.
C. Firm bids to buy and firm offers to sell.
D. Prices purchasers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy, and prices sellers have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell.

**Comments**

Nuexco does not consider the following in determining the Exchange Value:

A. The price of uranium delivered or to be delivered under old contracts.
B. The price of uranium delivered in connection with contract renegotiations or other than arm's length transactions.

[1] In December, 1981, Nuexco published a history of the Exchange Value which chronicled, month-by-month, changes in its definition, usage and derivation. Copies are available upon request.

**TRANSACTION VALUE**[2]
Determined as of January 31, 1983

| $/lb. $U_3O_8$ | Millions of Pounds | Number of Transactions | Number of Months |
|---|---|---|---|
| **19.35** | 5.4 | 12 | 3 |

**Definition**

The Transaction Value is a weighted average price of recent transactions, and is based on prices paid for $U_3O_8$ in transactions closed within the previous three-month period and for which delivery was scheduled within one year of the transaction date. At least ten transactions totaling at least two million pounds $U_3O_8$ are included in each calculation, or the sample time is extended as necessary to include these minima. Foreign currencies are converted to US dollars as of the transaction date.

**Comments**

Nuexco does not consider the following in determining the Transaction Value:

A. The price of uranium delivered in connection with contract renegotiations or other than arm's length transactions.
B. The price of uranium delivered in connection with contracts which call for "market price" mechanisms. This exclusion applies particularly to contracts in which delivery prices are expressed as a function of Exchange Value or any other independent variable. Also excluded from consideration are all data where the delivery price is defined in such a way that it cannot currently be determined.

[2] Transaction Values for 1976 through 1981 and their associated parameters (millions of pounds, number of transactions and number of months) are tabulated on pages 31 and 32 of Report 161. Corresponding data for 1982 are tabulated on page 5 of Report 173.

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*CURRENT MARKET DATA*

**CONVERSION VALUE[1] \$1.20/lb. U as $UF_6$**
Determined as of January 31, 1983

**Definition**

The Conversion Value is Nuexco's judgment of the price at which spot and/or near-term transactions for significant quantities of conversion services could be concluded in the secondary market as of the last day of the month.

**Derivation**

Nuexco bases the Conversion Value upon:

A. Data from recently completed transactions.
B. Data from pending transactions.
C. Firm bids to buy and firm offers to sell.
D. Prices purchasers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy, and prices sellers have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell.

**Comments**

Nuexco does not consider the following in determining the Conversion Value:

A. The price of conversion services delivered or to be delivered under old contracts.
B. The price of conversion services delivered in connection with contract renegotiations or other than arm's length transactions.

[1] Monthly data for 1981 and 1982 are tabulated on page 6 of Report 173.

**LOAN USE CHARGE RATE[2] 6%**
Determined as of January 31, 1983

**Definition**

The Loan Use Charge Rate is Nuexco's judgment of the annual interest rate at which uranium loans could be concluded as of the last day of the month.

**Derivation**

Nuexco bases the Loan Use Charge Rate upon:

A. Data from recently completed or pending loan transactions.
B. Rates included in firm proposals to borrow or lend.
C. Rates that potential borrowers and lenders have expressed as a willingness to pay or accept, but for which Nuexco is not aware of firm proposals.

[2] Monthly data for 1968 through 1981 appear on pages 32-34 of Report 162. Monthly data for 1982 appear on page 2 of Report 173.

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*CURRENT MARKET DATA*

## EXCHANGE VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

| Country (currency) | per lb. $U_3O_8$ in Concentrates | per kg $U_3O_8$ in Concentrates | per kg U in Concentrates |
|---|---|---|---|
| Australia (dollar) | 22.07 | 48.66 | 57.39 |
| Belgium (comm. franc) | 1,029 | 2,268 | 2,674 |
| Canada (dollar) | 26.56 | 58.56 | 69.06 |
| Finland (markka) | 116.03 | 255.80 | 301.65 |
| France (franc) | 148.07 | 326.44 | 384.95 |
| FRG (Deutschmark) | 52.26 | 115.21 | 135.87 |
| Italy (lira) | 30,197 | 66,572 | 78,504 |
| Japan (yen) | 5,078 | 11,195 | 13,202 |
| Netherlands (guilder) | 57.41 | 126.57 | 149.25 |
| South Africa (rand) | 22.92 | 50.53 | 59.59 |
| Spain (peseta) | 2,771 | 6,110 | 7,205 |
| Sweden (krona) | 159.73 | 352.15 | 415.27 |
| Switzerland (franc) | 42.76 | 94.27 | 111.17 |
| UK (pound) | 13.98 | 30.83 | 36.35 |
| US (dollar) | 21.50 | 47.40 | 55.90 |

## TRANSACTION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

| Country (currency) | per lb. $U_3O_8$ in Concentrates | per kg $U_3O_8$ in Concentrates | per kg U in Concentrates |
|---|---|---|---|
| Australia (dollar) | 19.86 | 43.79 | 51.65 |
| Belgium (comm. franc) | 926.10 | 2,041 | 2,407 |
| Canada (dollar) | 23.90 | 52.70 | 62.15 |
| Finland (markka) | 104.43 | 230.22 | 271.49 |
| France (franc) | 133.26 | 293.80 | 346.46 |
| FRG (Deutschmark) | 47.03 | 103.69 | 122.28 |
| Italy (lira) | 27,177 | 59,915 | 70,654 |
| Japan (yen) | 4,570 | 10,075 | 11,882 |
| Netherlands (guilder) | 51.67 | 113.91 | 134.33 |
| South Africa (rand) | 20.63 | 45.48 | 53.63 |
| Spain (peseta) | 2,494 | 5,499 | 6,485 |
| Sweden (krona) | 143.76 | 316.94 | 373.74 |
| Switzerland (franc) | 38.48 | 84.84 | 100.05 |
| UK (pound) | 12.58 | 27.75 | 32.72 |
| US (dollar) | 19.35 | 42.66 | 50.31 |

[1] Calculated using currency exchange rates published in the Wall Street Journal on January 31, 1983.

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*CURRENT MARKET DATA*

## CONVERSION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

| Country (currency) | per lb. U as $UF_6$ | per kg U as $UF_6$ |
|---|---|---|
| Australia (dollar) | 1.23 | 2.72 |
| Belgium (comm. franc) | 57.42 | 126.58 |
| Canada (dollar) | 1.48 | 3.27 |
| Finland (markka) | 6.48 | 14.28 |
| France (franc) | 8.26 | 18.22 |
| FRG (Deutschmark) | 2.92 | 6.43 |
| Italy (lira) | 1,685 | 3,716 |
| Japan (yen) | 283 | 625 |
| Netherlands (guilder) | 3.20 | 7.06 |
| South Africa (rand) | 1.28 | 2.82 |
| Spain (peseta) | 155 | 341 |
| Sweden (krona) | 8.92 | 19.65 |
| Switzerland (franc) | 2.39 | 5.26 |
| UK (pound) | 0.78 | 1.72 |
| US (dollar) | 1.20 | 2.65 |

[1] Calculated using currency exchange rates published in the Wall Street Journal on January 31, 1983.

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*CURRENT MARKET DATA*

## TRANSACTION SUMMARY[1]

### Uranium Transactions

| Nuexco Reference Number | Delivery Period | Approximate Quantity (thousands of pounds, $U_3O_8$ equivalent) | Approximate Price as Percent of Current E.V. | Seller | Buyer | Remarks |
|---|---|---|---|---|---|---|
| 2107 | 1983 | 301-600 | 90 | European Entity | European Utility | $UF_6$ |
| 2121 | 1983 | 301-600 | 95 | US Utility | US Producer | $UF_6$ |
| 2125 | 1983 | 601-1000 | unknown | US Producer | Far East Utility | |
| 2130 | 1983 | Less than 50 | 98 | US Producer | US Producer | |
| 2132 | FY88 | 301-600 | indeterminate | US Utility | European Entity | enriched $UF_6$ |

### Conversion Transactions

| Nuexco Reference Number | Delivery Period | Approximate Quantity (thousands of pounds, U equivalent) | Approximate Price as Percent of Current C.V. | Seller | Buyer | Remarks |
|---|---|---|---|---|---|---|

There are no conversion transactions reported this month

### Loan Transactions

| Nuexco Reference Number | Delivery Period | Approximate Quantity (thousands of pounds, $U_3O_8$ equivalent) | Approximate Price as Percent of Current L.U.C.R. | Lender | Borrower | Remarks |
|---|---|---|---|---|---|---|

There are no loan transactions reported this month.

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[1] Transactions listed are not limited to those in which Nuexco was involved, but also include others of which Nuexco is aware.

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## URANIUM SUPPLY
(As of 1/31/83)

| Nuexco Reference Number | Delivery Period[1] (Thousands of Pounds $U_3O_8$) | | Remarks |
|---|---|---|---|
| | Within 1 Year | Beyond 1 Year | |
| **Available for Sale:** | | | |
| **ACTIVE** | | | |
| 1575 | | 500 per year | Long Term |
| 1610 | 25 | | |
| 1818 | | 300 per year | Long Term |
| 1921 | 2,100 | | $UF_6$ |
| 2017 | | 2,300 | |
| 2020 | | 200 per year | 1983-92 |
| 2038 | 2,000 | | $UF_6$ |
| 2056 | 2,200 | | $UF_6$ |
| 2116 | 700 | | |
| 2126 | 500 | | $UF_6$ |
| 2158 | 700 | | |
| 2203 | 1,200 | | |
| TOTAL: | 9,425 | | |
| **INACTIVE** | | | |
| 1581 | | 100 per year | Long Term |
| 1805 | | 500 per year | Long Term |
| 1877 | 125 | | |
| 1928 | 1,000 | | $UF_6$ |
| 2196 | 500 | | |
| TOTAL: | 1,625 | | |

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[1] Measured from the date of this Report

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*CURRENT MARKET DATA*

## URANIUM DEMAND
## (As of 1/31/83)

| Nuexco Reference Number | Delivery Period[1] (Thousands of Pounds $U_3O_8$) | | Remarks |
|---|---|---|---|
| | Within 1 Year | Beyond 1 Year | |
| **Inquiries to Purchase:** | | | |
| **ACTIVE** | | | |
| 1652 | | 400 per year | Long Term |
| 1871 | | 250 per year | 1983-86 |
| 1995 | 250 | | |
| 1996 | | 400 | |
| 2010 | | 400 per year | 1984-92 |
| 2030 | | 1,000 | 1984-85 |
| 2042 | | 400 per year | Long Term |
| 2054 | 110 | | |
| 2061 | 40 | | |
| 2066 | | 200 | |
| 2105 | 600 | | $UF_6$ |
| 2123 | 500 | 500 per year | 1983-87 |
| 2167 | 250 | 250 per year | 1984-99 |
| 2180 | 3,000 | | |
| TOTAL: | 4,750 | | |
| **INACTIVE** | | | |
| 1459 | | 200 per year | Long Term |
| 1843 | 250 | | |
| 1888 | | 400 per year | Long Term |
| 1999 | | 50 per year | 1985-90 |
| 2025 | | 350 | |
| 2032 | | 200 | |
| 2108 | 2,200 | | |
| 2114 | 200 | 200 per year | 1984-90 |
| 2115 | 200 | 200 | |
| 2166 | 75 | | |
| TOTAL: | 2,925 | | |

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[1] Measured from the date of this Report.

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## CONVERSION SUPPLY
### (As of 1/31/83)

| Nuexco Reference Number | Delivery Period[1] (Thousands of Pounds U as $UF_6$) | | Remarks |
|---|---|---|---|
| | Within 1 Year | Beyond 1 Year | |
| **ACTIVE** | | | |
| 1609 | 500 | 1,500 per year | Long Term |
| 1840 | 130 | | |
| 1936 | 1,000 | 200 per year | Long Term |
| 2051 | 1,000 | | |
| 2143 | | 400 | |
| 2181 | 650 | 650 per year | Long Term |
| TOTAL: | 3,280 | | |
| **INACTIVE** | | | |
| 2008 | 800 | 800 | |
| TOTAL: | 800 | | |

## CONVERSION DEMAND
### (As of 1/31/83)

| Nuexco Reference Number | Delivery Period[1] (Thousands of Pounds U as $UF_6$) | | Remarks |
|---|---|---|---|
| | Within 1 Year | Beyond 1 Year | |
| **ACTIVE** | | | |
| 1995 | 220 | | |
| 2148 | | 400 per year | 1984-90 |
| TOTAL: | 220 | | |
| **INACTIVE** | | | |
| 1622 | 400 | | |
| 2129 | 500 | 500 | |
| TOTAL: | 900 | | |

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[1] Measured from the date of this Report.

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*CURRENT MARKET DATA*

## LOAN SUPPLY AND DEMAND
(As of 1/31/83)

| Nuexco Reference Number | Delivery Period[1] (Thousands of Pounds $U_3O_8$) | | Remarks |
|---|---|---|---|
| | Within 1 Year | Beyond 1 Year | |
| **Available for Loan:** | | | |
| **ACTIVE** | | | |
| 1938 | 1,500 | | |
| 2006A | 600 | | |
| 2121 | 600 | | |
| 2204 | 500 | 200 per year | Long Term |
| TOTAL: | 3,200 | | |
| **INACTIVE** | | | |
| 1815 | 1,000 | | $UF_6$ |
| 1884 | 600 | | |
| 1910 | 1,000 | | |
| 1931 | 600 | | |
| 2036 | 500 | | $UF_6$ |
| 2040 | 600 | | $UF_6$ |
| 2133 | 200 | | |
| 2157 | 600 | | |
| 2159 | 2,000 | | |
| TOTAL: | 7,100 | | |
| **Inquiries to Borrow:** | | | |
| **ACTIVE** | | | |
| 1998 | 200 | 200 | |
| 2006 | 600 | | |
| 2070 | 200 | | $UF_6$ |
| 2125 | 700 | | $UF_6$ |
| TOTAL: | 1,700 | | |
| **INACTIVE** | None | | |

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[1] Measured from the date of this Report

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## AFRICA

### Introduction

African uranium production in 1982 declined from 1981 levels and promises to be even lower in 1983. While South Africa, Namibia, Niger and Gabon all have the ability to expand production, they are unlikely to do so until market conditions improve. Much of the production from these countries is committed under long-term contracts at prices which are well above current spot levels, and some customers have successfully negotiated reduced delivery quantities.

### Central Africa

France remains the principal customer for output from **Niger** and **Gabon**. Niger's production during 1982 was 11.1 million pounds $U_3O_8$, essentially the same as in 1981. However, cutbacks of perhaps 20 percent are likely in 1983. Despite the completion of expanding processing facilities, Gabon's 1982 production of 2.5 million pounds $U_3O_8$ was approximately the same as 1981, with no significant increase expected in 1983. A decline is possible, especially if customers holding large inventories reduce or terminate deliveries.

### Namibia

**Rossing**, the world's largest uranium facility, continued to operate near full capacity, producing approximately 10 million pounds $U_3O_8$. There are some indications, however, that contracted deliveries are somewhat less and that inventory is being accumulated. The situation could worsen substantially if Rossing's United Kingdom customer carries out its announced plans not to renew its contract after it expires in 1984.

### Republic of South Africa

**South Africa**'s nuclear power program suffered somewhat of a setback at the end of 1982, when, on December 18-19, both of the Electricity Supply Commission's (ESCOM) Koeberg units were damaged by a series of explosions. (The African National Congress, a dissident group outlawed in South Africa, claimed responsibility for the sabotage.)

Operation of Koeberg Unit 1, which had been ready for fuel loading, will be delayed an indefinite period, perhaps as much as nine months if replacement parts for the damaged control rod drive mechanisms are not readily available. A complicating factor is the uncertainty with regard to how many of the mechanisms need to be replaced. The attack also called into question the adequacy of security measures at the site. Even though those security measures have been regarded as among the most stringent in the world, debate over the issue could prolong the anticipated delay.

* * *

In a year end review of the uranium market, Messrs. G. Langton and D.A. Etheredge, senior officials of Anglo-American, commented as follows:

"The uranium market continued to weaken during the past year to the extent that commercial spot prices in real rand terms, measured against average South African mine working costs, have fallen to their lowest level ever, despite the depreciation of the rand against the US dollar. These very low prices do not reflect long-term contract prices, which remain significantly higher, though they have come under pressure in the past few years.

"The current high costs of production in relation to prices are making the position intolerable for an increasing number of producers around the world and this is reflected in the steps taken by the US authorities to limit the volume of imports of foreign uranium. If this attempt to protect US uranium producers from free market forces is successful, a two-tier market probably will develop, and undoubtedly will exacerbate the projected supply-demand imbalance in the rest of the world."

The comments of Messrs. Langton and Etheredge may lend some perspective to the recent spot and near-term market price increases. The balance of market forces may have altered for the short term, but producers face some serious fundamental problems in the long term.

* * *

Generally, South Africa's gold and uranium industry encountered difficult conditions throughout the year, with both lower gold prices and uranium spot prices. However, despite these adverse factors, all the uranium producers (other than West Rand Consolidated, a high-cost primary producer) were able to remain in production. This resilience was largely due to the following factors.

1. Production costs are relatively low in general, because so much of South Africa's uranium is produced as a by-product or a co-product of gold.
2. The richness of South Africa's gold deposits enables the gold producers to remain profitable, even if both uranium and gold market prices are low.

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3. A weak rand relative to the dollar, and the fact that a large number of uranium sales and all gold sales were priced in dollars, combined to mitigate much of the effects of declining spot market prices and depressed worldwide demand for uranium. As a result, revenue in rand terms will probably exceed that of 1981 slightly, in spite of lower production.

4. The multitude of uranium-bearing reefs enhances producers' ability to vary grades and throughput to meet prevailing economic circumstances. For example, the weak uranium spot market led South African producers to trim back production where possible to meet contract commitments only, and not to overproduce for the spot market or for inventory.

5. South Africa's reputation for reliable supply has been an important factor in developing loyalty and sound long-term relationships among its traditional customers.

Final 1982 uranium production figures from South African gold-uranium operations (members of the Chamber of Mines) were released this month and are presented in Table 1. It also presents the corresponding figures for each quarter of the year. Table 1 includes all of South Africa's uranium production except that of Palabora, which is not a member of the Chamber of Mines. That figure is scheduled to be released in a few months.

**Table 1**

**REPUBLIC OF SOUTH AFRICA:**
**1982 URANIUM PRODUCTION FROM GOLD-URANIUM OPERATIONS**
**(thousands of pounds $U_3O_8$)**

| Operation | 1Q82 | 2Q82 | 3Q82 | 4Q82 | Total |
|---|---|---|---|---|---|
| Beisa (St. Helena) | 104[1] | 133 | 149 | 172 | 558 |
| Blyvooruitzicht | 164 | 153 | 127 | 113 | 557 |
| Buffelsfontein | 320 | 320 | 315 | 324 | 1,279 |
| CHEMWES | 336 | 280 | 376 | 346 | 1,338 |
| Dreifontein Consolidated | 129 | 125 | 129 | 112 | 495 |
| ERGO | 149 | 141 | 141 | 152 | 583 |
| Harmony | 316 | 326 | 329 | 332 | 1,303 |
| Hartebeestfontein | 239 | 229 | 226 | 251 | 945 |
| J.M.S. | 591 | 490 | 457 | 365 | 1,903 |
| Randfontein | 245 | 231 | 271 | 273 | 1,020 |
| Vaal Reefs | 756 | 983 | 1,062 | 994 | 3,795 |
| Western Areas | 58 | 100 | 105 | 112 | 375 |
| Western Deep Levels | 101 | 95 | 94 | 114 | 404 |
| TOTAL: | 3,508[2] | 3,606 | 3,781 | 3,660 | 14,555 |

[1] Revised production figure for startup phase.

[2] Revised since Report 165 to take account of revised figure for Beisa production in startup phase.

Some specific observations about the figures in Table A and about 1982 uranium production from gold-uranium operations in South Africa:

1. Fourth quarter production of approximately 3.7 million pounds $U_3O_8$ was down three percent from the third quarter output of 3.8 million pounds, but it was essentially the same as the corresponding figure for the fourth quarter of 1981.

2. The total for the year was approximately 14.6 million pounds $U_3O_8$, down 6 percent from the 1981 level of 15.5 million pounds.

3. 1982 saw the commissioning of St. Helena's new plant (Beisa) and a progressive build-up of tonnage during the year. First quarter production, initially announced in Report 168 as 122,000 pounds $U_3O_8$, has been revised to 104,000 pounds (during the startup

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phase). Fourth quarter production of 172,000 pounds led to a total for the year of 558,000 pounds $U_3O_8$.

4. At Blyvooruitzicht, fourth quarter and annual production for 1982 declined 11 percent and 20 percent, respectively, due to a 19 percent drop in average grade of ore treated. Unless able to contract at prices above current market levels, Blyvooruitzicht will likely cease production by the end of 1984 and meet its remaining obligations by deliveries from inventory.

5. In 1982, production at Buffelsfontein dropped 8 percent from 1981 due to lower average grade and lower throughput.

6. 1982, production at Chemwes was down 9 percent due to lower grades treated. Due to the recalculation of tonnage contained in the Stilfontein and Buffelsfontein slimes dams, the Stilfontein shareholding in Chemwes has been reduced from 85 percent to 80 percent and the Buffelsfontein share has been increased from 15 percent to 20 percent.

7. At Dreifontein Consolidated, lower grade and throughput caused fourth quarter production to decline by 13 percent from the third quarter. The annual total for 1982 was 7 percent less than 1981 for the same reasons.

8. At ERGO, 1982 production was 12 percent lower than 1981 due to lower grade.

9. Harmony production remained constant at approximately 325,000 pounds $U_3O_8$ per quarter and 1.3 million pounds per year.

10. Hartebeestfontein production was down 10 percent in 1982, due mainly to lower throughput.

11. J.M.S. production was down 21 percent in 1982, due to 25 percent lower tonnage throughput and a revised feed sources scheme.

12. Randfontein production was 22 percent lower than 1981, due to lower tonnage treated (12 percent less) and lower grade (12 percent less). Those factors came about as a result of cessation of operations at the millsite plant and due to operating difficulties during the year with the Cooke section uranium plant. The plant is now running at design efficiency, and extensions to it are currently underway.

13. Vaal Reefs overcame operating problems at the south uranium plant during the year, in time to equal 1981 output. During the year, the new Afrikander lease uranium plant was completed and put on a standby basis due to the depressed uranium market.

14. Western Areas commissioned its new uranium plant and progressively built up production during the year, from 58,000 pounds $U_3O_8$ in the first quarter, to 112,000 pounds in the fourth quarter. Planned efficiencies are now being achieved.

15. Western Deep Levels' 1982 production was down 14 percent, due mainly to lower grade (down 12 percent).

During 1982, nine Chamber of Mines uranium producers experienced declines in output, with Anglo American's JMS having the largest single decline, 478,000 pounds (twenty percent). Furthermore, 1982 saw the cessation of production at West Rand Consolidated, which had produced approximately 420,000 pounds $U_3O_8$ in 1981. Against these declines, the year brought new production from St. Helena's Beisa section (558,000 pounds) and from Western Areas (375,000 pounds). The year also brought marginal production increases at Vaal Reefs and Harmony. The net effect was an overall decline in 1982 production of almost one million pounds, almost six percent below 1981.

## AUSTRALIA

Two trends characterized the Australian uranium industry in 1982:

1. Producing mines and mills performed well. They exceeded production levels, met export schedules and reported profitable operations.

2. Companies whose uranium projects are still in the planning stage generally improved the status of their projects in terms of technical readiness, but made little progress in gaining market acceptance. Despite all the hard work, their goal of producing and delivering uranium is still six or seven years away, and this is as close as it has been ever since the discovery of the deposits.

Australia has the potential to become the largest uranium supplier in the world. To discover the potential in the form of uranium resources is one thing; to develop the fledgling industry to full adulthood is quite another. Although the past year brought some progress toward future growth, no actual growth in uranium production took place in Australia during 1982. In fact, the October closure of the Mary Kathleen Uranium (MKU) mill due to reserve exhaustion would have caused shrinkage had not the higher production of Nabarlek and Ranger compensated for the loss of one of Australia's oldest uranium mines.

Although uranium exports from these two operations had been delayed by union action in 1981, shipments continued without hindrance in 1982. The rational

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industrial relations practice of ERA, the owner of the Ranger Mine, helped much to set a cooperative climate for the Darwin dockyards. ERA (Energy Resources of Australia) reported a profit of A$37.9 million on uranium sales of A$146 million for the fiscal year ended June 30, 1982. For additional financial details, see Report 171. ERA's 1982 production was approximately 7 million pounds $U_3O_8$. The company is seeking additional markets, hoping to expand its share supported by substantial production capability. Its performance record, its management team, its easily expandable mine mill complex and its extensive reserves place the company in a most advantageous position as compared to its competitors.

The Nabarlek mill, owned by Queensland Mines Ltd., operated without disruption in 1982, producing approximately 2.8 million pounds $U_3O_8$. The company reported profitable results for the year, but published no figures. It needs to discover new reserves before it can offer post-1990 supplies to consumers. Exploration in the Arnhem Land leases is impeded by the need to obtain Aboriginal consent.

The partners of the Jabiluka Project (Pancontinental Mining Ltd. and Getty Development Corporation) were granted a 41-year mining lease over the Jabiluka uranium deposit by the Northern Territory government. The lease entitles the partners to proceed with mine and mill construction. Such a commitment, costing in excess of A$600 million, will require substantial support from consumers first. Despite strenuous sales efforts during 1982, no contracts were signed. The worldwide economic recession has not encouraged many utilities to enter into long-term sales contracts.

Western Mining Corporation's (WMC) Yeelirrie uranium project suffered a considerable setback during 1982, when Esso withdrew as partner from the project three months before the completion of the joint feasibility study. Although the study was completed on time, WMC was left with the task to find a new project partner and to dispose of the whole of the planned output. Yeelirrie production had been largely pledged to Esso under the joint venture agreement. So far, WMC has not found a successor to Esso. Even if it does, WMC is not likely to find a partner willing to accept the terms Esso accepted some years ago.

According to figures released by WMC, the Roxby Downs copper, gold and uranium deposit contains 32 million tonnes of copper, 2,832 million pounds of $U_3O_8$, and 1,200 tonnes of gold. Roxby Downs could contain twice as much uranium as all known Australian uranium deposits combined. Its relatively low grade will require large-scale underground operations to ensure its viability. As required by their indenture agreement with the state of South Australia, the joint venture partners, WMC and BP, will undertake a feasibility study to be completed by 1984. A decision on whether to proceed must be reached three years later.

Two other significant uranium deposits, Honeymoon and Beverly, are located in the state of South Australia. The newly-elected state government has thrown their development into uncertainty, at least for the time being. The Honeymoon partners, CSR and Teton, completed an in-situ leach pilot plant in November 1982. However, the project was put on a care and maintenance basis until the state uranium policy emerges. The non-Australian partner, Teton, is seeking to sell its project share and has stopped contributing financially to the project.

Negotiations between Denison and the Aboriginal traditional landowners over Koongarra have stalled. At year-end, Denison was concentrating on those mineral leases that do not require Aboriginal consent. In the interim, it is uncertain whether the differences between the parties will be resolved in time for the project to proceed in an orderly and economic manner. In addition to the environmental aboriginal and marketing problems, Denison must find Australian equity partners for 75 percent of the project.

The Mary Kathleen Uranium mill was finally closed in October 1982, having produced sufficient material to meet existing delivery obligations which extend to 1984. Production in 1982 was about 1,875,000 pounds $U_3O_8$. The mill was first closed in 1963, but was reopened in 1975 on the basis of contracts written in the late 1960s and early 1970s.

The small Lakeway project in Western Australia, owned by CSR and VAM Ltd., received development approval from State and Federal authorities. The partners have made some attempts to sell the future output, but so far without success. The deposit is 100 percent Australian-owned and the partners may offer a maximum of 25 percent equity participation to consumers. Its small size (one million pounds per year planned production) may have some attraction to a foreign utility in a depressed market.

The potential of the Westmoreland uranium deposit in Northern Queensland has been downgraded substantially following the failure to extend the known miner-

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alization. The partners involved in the project have held ambitious plans for extending the reserves previously outlined, but drilling during 1982 has failed to produce desired increases. The partners have previously disclosed reserves of 11,400 tonnes $U_3O_8$, but the geology of the deposit is such that a total of at least 15,000 tonnes would need to be developed before the project would be viable. The partners in the project are Queensland Mines Ltd. (40 percent), CSR (12.5 percent), IOL Ltd. (9.75 percent), and Urangesellschaft Australia Pty. Ltd. (37.5 percent).

The Australian enrichment group, UEGA, selected the Urenco-Centec technology for its impending feasibility study to establish a centrifuge enrichment plant in Australia in the 1990s.

During 1982, Australia concluded a bilateral safeguards agreement with Japan after four years of intensive negotiations. Safeguards talks with Egypt are continuing.

Uranium became once again a prominent item in Australian politics when the Australian Labor Party (ALP) modified its uranium policy in August 1982. The previous Labor Party policy required an incoming Labor government to end uranium mining and to repudiate existing sales contracts. The modified policy is less specific and would allow a Labor Government, if voted into office, more flexibility, but its very absence of clarity causes tension within the ALP. It was intended to contain sufficient hardline rhetoric to satisfy the Labor Party anti-nuclear faction, but also enough latitude to allow uranium mining and new developments, if politically expedient. The internal debate in the ALP has not stopped since the adoption of the new policy. However, if the Australian economy continues to decline, uranium may soon be replaced by the more necessary practical concern of rising unemployment.

The Liberal Government, despite many political setbacks, appeared at the end of the year firmly enough entrenched and sufficiently endowed with electoral favors to most likely win the next federal election, now scheduled for March 5, 1983. The Labor Party, in a surprise move, recently changed leaders from Mr. Hayden to Mr. Hawk. The new Labor leader has strong electoral appeal and the Liberal Party under Mr. Fraser will find in him a tough opponent with a very good chance of winning office.

The uranium policy under a Hawk-led Labor Party is not certain. However, based on general attitudes, it would not be surprising to find no new uranium mines allowed in Australia, except perhaps Roxby Downs. A uranium enrichment plant would likely find little acceptance with the Labor Party. If Labor won the election, its policies would likely be in effect for three years.

During 1983, Australian producers will face the challenge of renegotiating contract prices for current deliveries in the presence of a world economic climate which will set utilities against producer demands. Entering into new purchase commitments from mines in the planning stage will take, next year, more courage than ever from utilities, because even the utilities' own projections of demand growth must be uncertain.

## EUROPE

**Belgium**'s proportion of electricity generated by nuclear power in 1982 was 27.7 percent. During the course of the year, Doel 3 and Tihange 2, 900 MWe each, were connected to the grid. Belgium's installed nuclear capacity at the end of 1982 was 3,450 MWe, if one counts reactors actually operating in the country (i.e., 100 percent of Tihange 1 and 0 percent of Chooz) or 3,170 MWe if Belgium's actual share of the nuclear power plants is taken into consideration (i.e., 50 percent of Tihange 1 and 50 percent of Chooz in France).

It has been announced that the operation of Doel 3 and Tihange 2 will enable electricity prices to be lower in 1983 than they would have been with conventional power plants. A reduction of 0.13-0.20 Belgian francs per kilowatt hour is predicted.

Belgium is considering taking a 20 or 25 percent stake in the two 1300 MWe plants France wants to build at Chooz. Belgium would take 20 or 25 percent of the electricity produced. A decision on this is tied up with Belgium's future energy policy. It is thought that at least one 1300 MWe plant will be needed during 1991, but accepting France's offer would force Belgium into giving the order for the new plant (probably Doel 5) to Framatome. This cooperation with Framatome could help the Belgian nuclear sector to survive, but would take away Belgium's chance to diversify its suppliers to Westinghouse or Kraftwerk Union (KWU).

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Installed nuclear capacity in **France** at the end of 1982 was 23,400 MWe. During the year, two reactors were connected to the grid, Blayais 2 (920 MWe) and Chinon B1 (900 MWe). Seven reactors are expected to

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start up in 1983: Blayais 3 and 4, Chinon B2, Cruas 1 and 2, and Paluel 1 and 2.

Chinon B4 (900 MWe), Nogent 2 (1300 MWe) and Cattenom 3 (1300 MWe) were the first three out of the six reactors for which the French government gave approval in 1981 for construction starts in 1982-83. These will come onstream in 1987 and 1988.

Preparations are underway for the ninth five-year plan for the years 1984-88. Estimates of economic growth and energy consumption in the 1990s are being revised substantially downwards. Also, rumors are circulating that as few as three construction starts for 1984-85 may be authorized instead of the six presently planned. The new plan will be published in the spring of 1983.

The average availability figures for French PWRs fell in 1982 to approximately 56 percent (down from 63 percent in 1981 and 69 percent in 1980). This drop was due to the larger than usual number of units (seven) which were shut down for the usual four-month checkup after 18 months on line, to turbine-generator problems, and to a spate of incidents including the replacement of all the control rod guide tubes on six stations. For this reason, the nuclear share of total electricity output in 1982 was 38.7 percent, approximately the same as 1981. It is expected that this figure will reach nearly 50 percent at the end of 1983 and 70 percent by the end of the decade.

Cogema's activities in the US market must be one of the major highlights for 1982. Acquisition of Pathfinder Mining Company was concluded at the beginning of 1982 and, in the summer, Cogema established a US subsidiary to service the American market, Cogema Inc. At the end of 1982 it was announced that Cogema Inc. had sold enriched uranium to a US utility which marks its first penetration in this market.

In France, Cogema acquired 17.33 percent of Imetal which controls significant uranium production in France and shares in Comuf, Somair and Amok abroad.

Other changes of significance in the structure of the uranium mining industry in France were:

1. The acquisition by Total (CFP) of PUK's 50 percent share of Minatome, giving it a 100 percent interest. Pechiney Ugine-Kuhlmann (PUK) is withdrawing from Minatome (50 percent PUK and 50 percent C.F.P.). Uranium Pechiney, subsidiary of PUK, will give over to C.F.P. its 50 percent share in Minatome. Pechiney will take back the projects which it held before the formation of Minatome in 1975. These were the 12.99 percent in COMUF (Gabon), 7.58 percent in Somair (Niger) and 25 percent in AMOK (Canada). C.F.P. (Total Group) is left essentially with Scumra in France, the Rossing shareholding and the partnership working teams of exploration.

2. The acquisition by Total of Dong Trieu from the Schneider Group. This makes Total the number two organization in the French uranium mining industry. Dong Trieu (DT) announced on December 31, 1982 that the Total Group had purchased control of Dong Trieu from Schneider S.A. In France, DT owns uranium reserves of 7,000 tonnes U which it is exploiting at the rate of 450 tonnes U per annum. DT is thus the second largest uranium producer in metropolitan France. It also holds interests abroad and is at present studying their potential.

Taking control of DT marks for Total a new step in the development of its uranium sector, where it already holds considerable interests in France and abroad. Those are held through Minatome which is now a wholly owned subsidiary of the Total Group.

The Total Group's acquisition of Dong Trieu and Minatome makes possible the formation of a French mining group of international stature. There are now only two significant uranium mining groups in France, Cogema and Total. The exploration interests of DT and Minatome will complement one another, and adding together Scumra and DT production in France will give Cogema a sizable competitor.

3. In the enrichment field, Eurodif's gaseous diffusion plant at Tricastin achieved full capacity of 10.8 million SWU at the end of 1982. Full capacity could have been achieved much earlier, but reduced demand and the desire to smooth out the possible economic problems of its subcontractors led the company to delay that date. It is predicted that Eurodif production will be geared to demand and a possible figure for 1983 production is 5-6 million SWU.

4. The decision for Framatome and Cogema to build a fuel fabrication plant at Pierrelatte was taken in 1982. It will have an initial capacity of 500 tonnes and is scheduled to be in production in 1984. Capacity at FBFC's plants at Romans in France and Dessel in Belgium totals 800 tonnes.

5. France began to reprocess fuel from its PWR program this year, although since 1976 it has reprocessed 500 tonnes of oxide fuel from LWRs in Europe and Japan. In March 1982, the French government finished its examination of Cogema's investment program at Cap La Hague. It gave its approval for the building of two

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new reprocessing plants by the late 1980s, one for the domestic market and one for foreign spent fuel.

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In the **Netherlands**, the two commissions mentioned in our summary of events for 1981 were still at work throughout 1982. The first was initiated in response to the activities of the strong opposition groups to nuclear power in the 1970s and was intended to be a discussion by all sides on whether to build any more nuclear power plants. A report by the Brede Maatschappelijke Discussie was scheduled for publication at press time, and a final report is expected by the end of 1983. With the downturn of electricity consumption, some knowledgeable sources say that no decision on new nuclear plants will be needed for many years. Indications of official attitudes can be drawn from the 1982 decision to suspend, after 1986, the 90 percent government financing of Neratoom, the national nuclear research and investment consortium. The Netherlands has also virtually withdrawn from the Kalkar fast breeder reactor demonstration project on which it was collaborating with West Germany and Belgium.

The second commission, called the Beek Commission, was appointed to study the implications of closing the two nuclear plants which are operating in the Netherlands, Dodewaard (54 MWe) and Borssele (475 MWe). The commission is in the process of finalizing its studies. There is no expectation that the plants will be closed down. The fear of tremendous economic losses in the wake of the plants' closure acts as an important deterrent.

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**Portugal** produced approximately 290,000 pounds $U_3O_8$ in 1982. The country's producing entity, ENU (Empresa Nacional de Uranio) continued prospecting in an area of the central region of Portugal called Azere, which is being drilled with promising results. ENU also maintained negotiations with some foreign companies to form joint venture associations for exploration in selected areas of Portugal where radioactive indications have already been found. These are expected to be concluded during 1983.

ENU proceeded with the feasibility study for the Nisa deposits in the southeastern part of Portugal. It is planned to start construction of the mill and treatment plant during 1984 with a view to production starting at the end of 1986 or the beginning of 1987. Annual production from Nisa is expected to exceed 500 thousand pounds $U_3O_8$.

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In **Switzerland**, the Kaiseraugst nuclear station made its way through another step in the cumbersome Swiss approval process for nuclear power plants. The plant received the approval of the Staemderat (upper house) of the Swiss Parliament by a vote of 32-10. The lower house still has to vote on the issue, and this is not expected to happen until early 1984. If the lower house approves, construction can begin immediately. But it is not likely to do so since some of the contracts for the plant will no doubt have to be renegotiated. Thus, construction is expected to begin in late 1984.

Under the current Swiss law, a nuclear plant must go through several stages of approval. The general authorization is received from the Bundesrat (executive branch) having determined a need for power. Then both houses of Parliament must approve the plant. This is in addition to other safety regulations.

The deciding issue in the Staemderat vote appeared to be need for power. When the Kaiseraugst plant was first considered, it was based on an estimated electric load growth of 2.2 percent per year. In fact, the Swiss growth rate has been 2.7 percent, thus a shortage of power was foreseen by 1990 without new nuclear plants beyond Leibstadt, which is nearing completion. The Staemderat also passed an advisory vote (28-10) asking the Bundesrat to reconsider the requirement for cooling towers for the plant. The two cooling towers have been the source of most local opposition to the project. The government position on this issue is that it will be difficult to change to direct cooling without the concurrence of Germany and France, since the Rhine river also flows through those nations. The Graben nuclear plant will have to go through the same approval process as Kaiseraugst before it can begin construction.

A proposed new Swiss referendum on nuclear power represents another potential threat. If the supporters of the referendum are successful in collecting enough signatures to place it on the ballot, the Kaiseraugst decision could be reversed. The referendum, which is the supreme law in Switzerland, would provide that no new nuclear power stations be permitted after Leibstadt. Several years ago, a previous Swiss referendum against nuclear power was barely defeated by a vote of 51 percent to 49 percent, with about half of the eligible voters participating.

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At the end of 1982, installed nuclear capacity in the **United Kingdom** remained the same as in 1981, 6,700 MWe, accounting for approximately 12 percent of electricity output. None of the six long-delayed AGR units was commissioned in 1982, despite the fact that fuel has been loaded in three of them for some time. Commissioning problems have continued to affect these reactors which were ordered in the 1960s. Much of the work on these plants was completed almost ten years ago. All six units are expected to be connected to the grid in 1983—Dungeness B1 and B2, Hartlepool R1 and R2, and Heysham A1 and A2. Although their total rated capacity is 3,030 MWe, they will not be run at their design ratings, so they will add a total of approximately 2,760 MWe to the U.K. grid. Two pairs of AGRs—Heysham B1 and B2, and Torness Point 1 and 2—are, however, on schedule for startup in 1988.

No new reactors were ordered in 1982 and all attention is being focused on the public inquiry into the PWR system which started on January 11. The CEGB requires statutory consent to build a PWR at Sizewell B. It would be for 1,100 MWe with construction to start in 1984 and an onstream date of 1991.

In the submission for the inquiry, CEGB has postulated three scenarios for the 1990s which would require new nuclear capacity of the following magnitudes:

1. The high case would need 12,000 MWe;
2. The medium case would require 9,000 MWe;
3. The low case postulated no new nuclear power.

If approval for Sizewell B is given, it is expected that the subsequent nuclear stations will be PWRs. However, a recent newspaper article has cited a government source as stating that no more than four or five subsequent stations will be ordered, instead of the government's plans of three years ago to order one nuclear station a year in the decade from 1982. It can certainly be argued that electricity demand is expected to remain static for a few years and grow only slowly in the 1990s, but obsolete plants must be replaced and at least 3,000 to 4,000 MWe of Magnox capacity must be retired in the 1990s.

Urenco's enrichment capacity at the end of 1982 was 1,000,000 SWU per year, split between Capenhurst in England and Almelo in the Netherlands. Plants in both countries are suitable for expansion as demand arises.

Urenco reportedly obtained new enrichment orders during the year. The news in October that Urenco has been chosen by the Uranium Enrichment Group of Australia as a future partner for its proposed enrichment plant has provided a strong boost for the company, although it is recognized that it may well be in the late 1980s before construction starts.

* * *

The most significant events in 1982 in **West Germany** (FRG) were:

1. The resumption of licensing in the form of first part-construction permits for the Konvoy units Isar 2, Emsland (Lingen), Neckar 2 (GKN), and Biblis C.
2. The starting of the Grafenrheinfeld nuclear reactor.
3. The granting of the final construction permit for Brokdorf.
4. The start of construction on the gas centrifuge plant in Germany at Gronau on the Dutch border. It had been delayed for four years for political and administrative reasons. The first step of capacity will be for 400,000 SWU to come into service in 1986; it can be expanded to 1,000,000 SWU per year as demand indicates.
5. Perhaps most important, the parliamentary change in government on October 1 when the pivotal third party, the Free Democrats (FDP), switched from a coalition with the Social Democrats (SDP) to one with the more conservative Christian Democrats (CDU). The business community has viewed the change very positively. In addition, the Christian Democrats are pro-nuclear, and an extended period of CDU rule in Germany should bode well for nuclear power. A federal election has been called for March 6, 1983. If the Christian Democrats can remain in power after that election, economic recovery in Germany and the recovery of the German nuclear industry are generally hoped for.

One dark cloud on the horizon is in the form of a fourth political party in Germany, the notorious Greens. The Greens started out as an anti-nuclear power movement and have developed into an anti-technology, pro-disarmament party whose members are generally less than 30 years of age. Thus far, the Greens have not had any members in the federal parliament since, under German law, a party must draw at least five percent of the vote in order to have representation, and the Greens have not done so yet. However, recent public opinion polls have given the Greens as much as 6.5 percent of the electorate. (The Greens are already represented in six of the eleven state governments.)

At the same time, the shift in allegiance of the Free Democrats has been thought to cost that party support, and its share may slip to less than five percent. That has led to fears that the Greens may replace the Free

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Democrats as the pivotal third party in Germany. If this happens, and if neither the Social Democrats nor the Christian Democrats pull an absolute majority in the March election, a coalition including the Greens will amost certainly result in further stagnation of nuclear power in particular, and perhaps the economy in general.

However, many observers are optimistic that the Christian Democrats will be returned to power in March, and the progress made in restoring the nuclear option in Germany will continue. The results of a recent FRG public opinion poll on the issue, conducted by the Emnid Institute and published on February 3, bolstered that optimism. The poll concluded that, had the upcoming federal election been held that day, the Christian Democrats would have received 49 percent of the vote, the Social Democrats 41 percent, the FDP *only 4 percent*, and the Greens 5 percent. Although the Greens' share of the opinion poll dropped from a previous high of 6.4 percent, a 5 percent share would still be enough to win a share of the seats in the Bundestag. The seats would then be distributed among the Christian Democrats, the Social Democrats and the Greens, in proportion to their relative shares, effectively ignoring the FDP's 4 percent. Thus, the Christian Democrats' 49 percent of the total would translate into an absolute majority of the Bundestag seats. They would then be able to form a government without the need to include the Greens as part of a coalition.

The poll has two overall implications that are favorable for nuclear power:

1. Support for the Christian Democrats is increasing.
2. Support for the Greens is decreasing. This would be especially favorable for the future of nuclear power in Germany if the Greens' support dropped below 5 percent.

## FAR EAST

**Japan**'s nuclear generation of electricity has increased steadily in recent years, such that nuclear power now is an important contribution to Japan's energy balance. In fact, it has recently surpassed hydroelectric output.

### Reduced Growth Forecast

The Japanese Cabinet decided in April 1982 to lower its official target for installed nuclear power generating capacity to 46,000 MWe by 1990. The plan calls for nuclear power to constitute 22 percent of total capacity by 1990, and to furnish 30 percent of the total electricity generation. The previous target, established in 1981, had been more than 10 percent higher. Given current siting and licensing constraints, the new target seems optimistic. For example, TEPCO may soon delay by 6-12 months the commercial operating dates for Kashiwazaki Unit 1 (now scheduled for 1985) and Fukushima Units 3 and 4 (1985 and 1986).

The Japan Energy Economy Research Institute (JEERI) has published a long range forecast of power supply containing a nuclear power forecast which has a higher probability of success than do the official government targets. For example, JEERI forecasts that installed nuclear capacity in 1990 will be 38,000 MWe, constituting about 18 percent of energy supply. This compares to the official target of 46,000 MWe and 22 percent. Those figures correspond closely to Nuexco projections of 44 or 45 units and 36,000 to 37,000 MWe in service by 1991. Under such a scenario, Japanese utilities would only need to complete those units already under construction or authorized by the EPRDC, *plus 4 to 6 more*. A scenario in which 41 units comprising approximately 33,000 MWe are in operation by 1991 should be regarded as quite conservative. It is in the range between those 41 reasonably assured units and the target's 54 units that the uncertainty lies. In any case, Japan's annual rate of uranium consumption should remain below ten million pounds $U_3O_8$.

While official forecasts for nuclear power growth in Japan were reduced in 1982, there were numerous positive developments as well:

1. After a 6-month suspension, Japan Atomic Power Co.'s (JAPC) Tsuruga Unit 1 returned to commercial service on January 22. The suspension had resulted from a March 1981 spillage of radioactive waste which had been concealed from the authorities until April.
2. Chubu Electric Co. placed the order for its Hamaoka Unit 3, scheduled to begin service by 1986.
3. Shikoku's Ikata Unit 3 was scheduled for 1988 operation.
4. On January 26, the Ministry of International Trade and Industry (MITI) issued a construction permit to JAPC for its Tsuruga Unit 2, a 1,160 MWe PWR, scheduled to begin operations in 1987.
5. Hokkaido's Kyowa-Tomari Units 1 and 2 received official authorization from the EPRDC (Electric Power Resources Development Council). Construction is scheduled to start by late 1983, in order to begin operating by late 1988 for Unit 1 and early 1990 for Unit 2.

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6. TEPCO's (Tokyo Electric Power Company's) Fukushima II-1 entered commercial operations on April 20.
7. Shikoku's Ikata Unit 2 (566 MWe PWR) was placed in service.
8. Kyushu's Genkai Unit 2 was placed in service.
9. In September, the EPRDC formally approved the construction of Kyushu Electric Power Company's Genkai Units 3 and 4, two 1,180 MWe PWRs. Construction is scheduled to begin in 1984, for commercial operations in 1990 and 1991.

As of the end of 1982, Japan had 24 commercial nuclear power plants in operation, with an aggregate capacity of approximately 17,000 MWe, accounting for 12.5 percent of Japan's total power generating capacity. There are approximately 10,000 MWe under construction and preparations are being made for the construction of another 10,000 MWe. Of that amount, approximately half has been approved by the EPRDC.

During their 1982 fiscal year, the average availability factor of Japan's 24 operating reactors exceeded 70 percent for the first time. The unusually high figure for Japan is attributable to:

1. Shortening of the downtime for required periodic inspections.
2. More rapid startup procedures through the use of improved fuel designs.
3. Improved preventive maintenance techniques.

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Uranium marketing activity continued at a reduced level. Large uranium inventories, large long-term forward commitments and the sustained weakness of market prices led Japanese buyers to feel much more comfortable about their long-term security of uranium supply. Sales efforts of uranium producers met with little success, if any, and Japan's long-term suppliers encountered a substantially tougher attitude toward annual price negotiations.

Japanese utilities completed negotiations with two of their major suppliers with respect to 1983 delivery prices. The agreed upon prices, $35.40 and $35.45 per pound $U_3O_8$, were lower than the $37.00-$38.50 range negotiated in 1981 for 1982 deliveries. Furthermore, they were substantially below the $45.00 prices negotiated in 1980 for 1981 deliveries. This price erosion can be expected to continue during 1983 negotiations for 1984 delivery prices. It would not be surprising to see price reductions of $5 to $10 come out of the current round of negotiations.

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An important aspect of **Japan**'s nuclear development during 1982 was the intensified effort to develop its own fuel cycle. Rather than depending so much on the purchase of fuel cycle services from other countries, Japan has undertaken a national effort to develop its own capabilities in reprocessing, waste storage and disposal, conversion and enrichment. For example, PNC (Power Reactor and Nuclear Fuel Development Corporation) is operating a pilot enrichment plant. PNC is also carrying out batch operations at its pilot plant for $UF_6$ production. The plant is unusual in that the technology, developed by PNC, allows the production of $UF_6$ directly from uranium ore without passing through the $U_3O_8$ stage. Eventually, the development of indigenous capabilities in those areas will enable Japan to increase its security and diversity of supply throughout the fuel cycle.

* * *

The **People's Republic of China** (PRC) became a more prominent participant in the world market during 1982. Plans for the Canton-Hong Kong (Guangdong) nuclear power project firmed and the PRC government officially approved the project. To be sited approximately 40 miles north of Hong Kong, it could be in operation by the early 1990s. Offering one of the few opportunities for near-term reactor orders, the PRC is being actively pursued by US and French vendors. US vendors are handicapped by the lack of a bilateral safeguards agreement between the US and the PRC, which has signed a protocol of an agreement for cooperation in the nuclear field. Although the protocol does not cover power reactor sales, it does appear to increase Framatome's chances of winning the reactor order.

The PRC also participated in a limited way in the uranium market. During July, the PRC delivered approximately 65,000 pounds $U_3O_8$ to Japan's Power Reactor and Nuclear Fuel Development Corporation (PNC). Although China had exported $U_3O_8$ to other Communist countries before, this delivery was the first PRC export to a non-Communist customer.

* * *

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**Table 2**

**TAIWAN NUCLEAR POWER PROGRAM:**

| Unit | Type | MWe | Status at 12/31/82 |
|---|---|---|---|
| Chin-shan 1 | BWR | 604 | Operational since 12/78 |
| Chin-shan 2 | BWR | 604 | Operational since 9/79 |
| Kuosheng 1 | BWR | 951 | Operational since 12/81 |
| Kuosheng 2 | BWR | 951 | Loaded fuel 3/82<br>Generated first electricity 6/82<br>Reached full power 10/82<br>Power range testing underway |
| Total: |  | 3,110 |  |
| Maanshan 1 | PWR | 907 | Operation scheduled 4/84 |
| Maanshan 2 | PWR | 907 | Operation scheduled 4/85 |

**Taiwan**'s nuclear power program continued approximately on schedule during 1982. Kuosheng Unit 2 progressed relatively smoothly through the final stages of construction and testing, ending the year on the verge of commercial operations.

Taiwan's national energy plan as of early 1982 had called for the construction of six more nuclear units, representing 6600 MWe, by the year 2000. Although generally depressed economic conditions and lowered forecasts of electricity demand led to the government's decision to defer planned Units 7 and 8, Taiwan's long-term energy future is still heavily committed to nuclear power.

Taiwan lacks indigenous sources of uranium and political circumstances dictate that uranium may only be purchased from South Africa and the US. That, and the fact that a substantial portion of the financing for Taipower's nuclear program has come from the Export-Import Bank, have enabled the US to maintain a preferred supplier position, both with respect to reactors and to uranium. During 1982, non-US reactor suppliers, particularly Framatome, vigorously challenged the US position.

Taipower ended 1982 with three nuclear power plants in operation, two under construction and Kuosheng Unit 2 generating electricity before entering commercial operations. The program is summarized in Table 2.

## UNITED STATES

Both the US and the non-US uranium markets operated in 1982 under the threat of a renewed US restriction on uranium imports. More than a year after the first hearing on the viability of the US uranium industry, President Reagan signed into law Public Law 97-415 on January 4, 1983. The final language of the NRC Authorization Act, emerging after many twists and changes, can be viewed as a watered-down victory for the pro-import quota forces.

While the law does not contain the original call for a moratorium on foreign uranium contracting when imports reached 37.5 percent of US demand, the rhetoric of the Act does allow for the eventual implementation of such a restriction.

The Act calls for a comprehensive review of the US mining and milling industry to be submitted within 12 months of the Act's passage. Specific areas are outlined for review, including not only estimates of future uranium requirements, inventories and production levels, but also price levels under various scenarios.

The Act additionally calls for monitoring by the Secretary of Energy of the viability of the domestic mining and milling industry. The Secretary's determination is to be presented in annual reports to Congress and the President during the period 1983 to 1992. The criteria for the reports are to be established by September of this year, and topics to be covered are outlined. The report will include answers to the questions: "Can domestic reserves supply all future needs for a future 10-year period?" and what is the "level of domestic nuclear power needs for a 10-year period?" Such questions will provide many opportunities for interpretation.

The Secretary of Energy, based on the annual reports, can trigger two additional courses of action, if he determined that the level of imports represents a "substantial cause of serious injury, or threat thereof" to the US mining and milling industry—an investigation by the US International Trade Commission would be triggered. The secretary can also request investigations by the Secretary of Energy to "determine the effects on the national security of imports of source material" based on the 37.5 percent import level.

While the US has still not enacted any renewed uranium import restrictions, the new law established a mechanism which will make it necessary to readdress the issue in the future. The pro-import restriction forces can be expected to begin lobbying to formulate the criteria for the various reports and studies so as to speed up the process. The terms "viability" and "national security interests" are ambiguous enough to allow a wide range of interpretations. Thus, Public Law 97-415 maintains a Congressional focus on the domestic uranium industry, a partial victory for those in favor of uranium import restrictions.

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## HISTORICAL EXCHANGE VALUES

Determined as of the last day of the month indicated (US Dollars/lb. $U_3O_8$)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1968 | — | — | — | — | — | — | — | 6.35 | 6.35 | 6.40 | 6.45 | 6.50 |
| 1969 | — | 6.35 | 6.10 | 6.10 | 6.25 | 6.25 | 6.20 | 6.20 | 6.15 | 6.15 | 6.15 | 6.20 |
| 1970 | 6.30 | 6.30 | 6.30 | 6.30 | 6.30 | 6.30 | 6.30 | 6.20 | 6.15 | 6.15 | 6.15 | 6.15 |
| 1971 | 6.20 | 6.20 | 6.20 | 6.20 | 6.15 | 6.05 | 6.00 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 |
| 1972 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 |
| 1973 | 5.95 | 6.00 | 6.10 | 6.20 | 6.45 | 6.50 | 6.50 | 6.50 | 6.50 | 6.50 | 6.75 | 7.00 |
| 1974 | 7.70 | 7.90 | 8.00 | 9.00 | 9.50 | 10.50 | 11.50 | 12.00 | 12.50 | 14.00 | 14.75 | 15.00 |
| 1975 | 16.00 | 16.00 | 18.00 | 20.00 | 21.00 | 23.00 | 24.70 | 26.00 | 26.00 | 28.50 | 30.00 | 35.00 |
| 1976 | 35.20 | 37.00 | 39.25 | 40.00 | 40.00 | 40.00 | 40.00 | 40.40 | 41.00 | 41.00 | 41.50 | 41.00 |
| 1977 | 41.35 | 41.50 | 41.60 | 41.60 | 42.00 | 42.25 | 42.25 | 42.25 | 42.40 | 42.75 | 43.20 | 43.20 |
| 1978 | 42.90 | 43.25 | 43.25 | 43.25 | 43.40 | 43.40 | 43.40 | 43.10 | 43.25 | 43.00 | 43.25 | 43.25 |
| 1979 | 43.25 | 43.25 | 43.25 | 43.25 | 43.25 | 43.00 | 42.70 | 42.70 | 42.20 | 42.20 | 41.00 | 40.75 |
| 1980 | 40.00 | 38.00 | 35.00 | 32.00 | 32.00 | 31.50 | 31.50 | 30.00 | 28.50 | 28.00 | 28.00 | 27.00 |
| 1981 | 25.00 | 25.00 | 25.00 | 25.00 | 25.00 | 24.25 | 23.50 | 23.50 | 23.50 | 23.50 | 23.50 | 23.50 |
| 1982 | 23.00 | 23.00 | 22.50 | 20.75 | 20.50 | 19.25 | 18.25 | 17.00 | 17.00 | 17.50 | 19.75 | 20.25 |
| 1983 | **21.50** | | | | | | | | | | | |

## HISTORICAL TRANSACTION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. $U_3O_8$)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1976 | — | — | — | — | 39.60 | 39.70 | 39.70 | 40.40 | 40.30 | 40.60 | 40.70 | 40.70 |
| 1977 | 41.30 | 41.30 | 41.40 | 41.50 | 42.80 | 42.90 | 43.00 | 42.60 | 42.50 | 42.80 | 42.90 | 42.90 |
| 1978 | 43.10 | 43.30 | 43.70 | 43.60 | 43.60 | 43.20 | 43.30 | 43.40 | 43.40 | 43.60 | 43.40 | 43.70 |
| 1979 | 43.60 | 43.80 | 43.70 | 43.40 | 43.60 | 43.70 | 43.70 | 43.60 | 43.60 | 43.60 | 43.50 | 42.30 |
| 1980 | 42.00 | 39.30 | 38.60 | 38.40 | 37.90 | 37.60 | 37.30 | 31.60 | 30.60 | 29.00 | 28.70 | 27.70 |
| 1981 | 27.20 | 27.20 | 27.00 | 25.70 | 25.70 | 24.50 | 24.40 | 24.30 | 23.90 | 24.10 | 24.10 | 24.00 |
| 1982 | 24.00 | 23.70 | 23.40 | 22.60 | 22.70 | 21.50 | 20.30 | 19.10 | 17.30 | 17.00 | 17.55 | 18.80 |
| 1983 | **19.35** | | | | | | | | | | | |

## HISTORICAL CONVERSION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. $U_6$)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1981 | 1.20 | 1.20 | 1.20 | 1.40 | 1.15 | 1.15 | 1.15 | 1.10 | 1.10 | 1.10 | 1.20 | 1.20 |
| 1982 | 1.20 | 1.20 | 1.20 | 1.20 | 1.00 | 1.00 | 1.00 | 0.90 | 1.10 | 1.60 | 1.45 | 1.45 |
| 1983 | **1.20** | | | | | | | | | | | |

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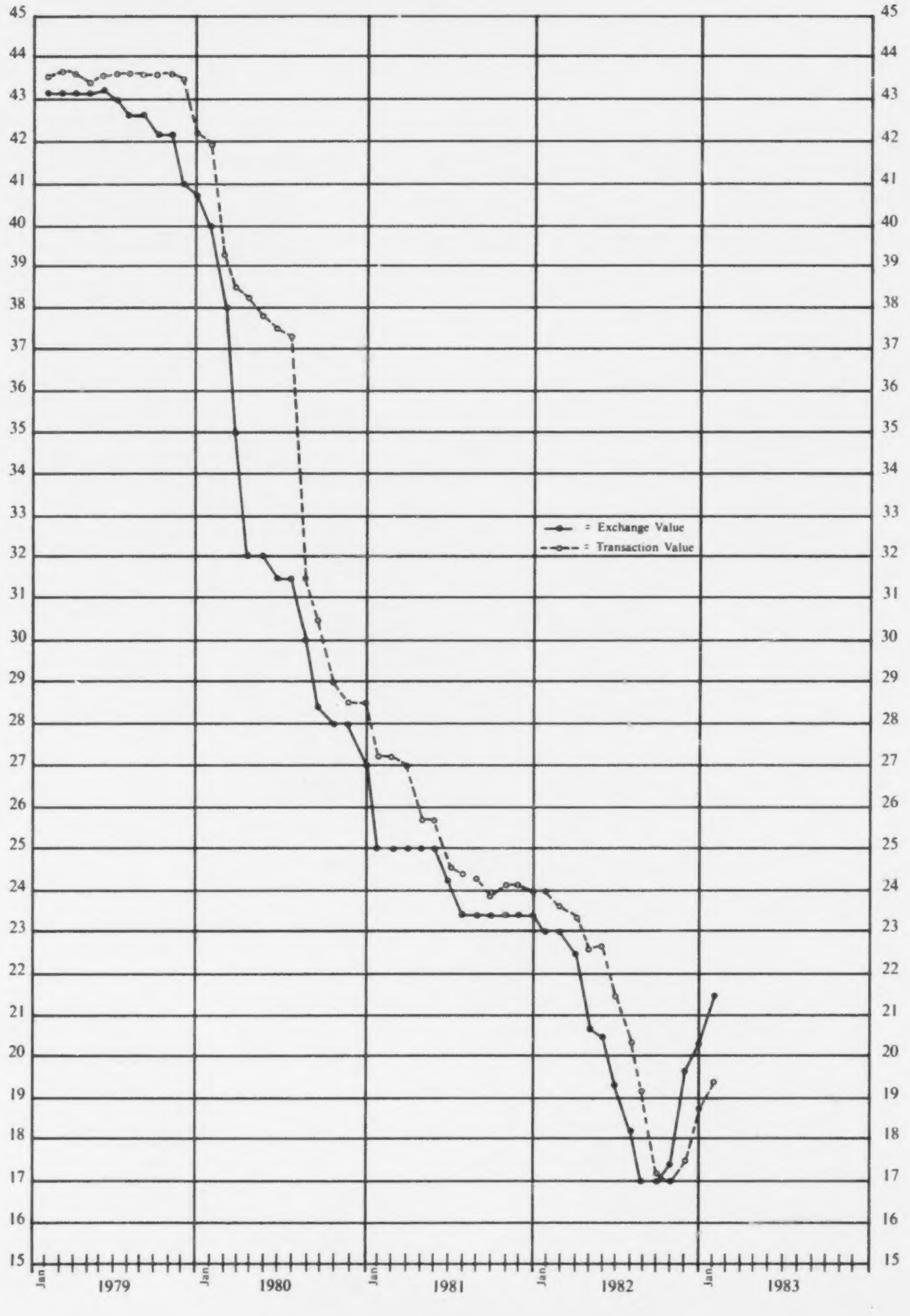
## *HISTORICAL MARKET DATA*

### EXCHANGE AND TRANSACTION VALUES SINCE JANUARY 1979

Determined as of the last day of the month indicated



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## AUSTRALIA

| | Price Index of Materials Used in Manufacturing Industry—All Groups (Year 1968-69 = 100.0)[1] | Weighted Average Rate of Pay Indexes Australia—Adult Males Wage Earners, Weekly Rates (Year 1976 = 100.0)[2] |
|---|---|---|
| Annual Avg. 1971[3] | 101.5 | 65.95 |
| Annual Avg. 1972[3] | 105.6 | 71.26 |
| Annual Avg. 1973[3] | 124.4 | 78.96 |
| Annual Avg. 1974[3] | 141.9 | 108.07 |
| Annual Avg. 1975[3] | 150.4 | 132.55 |
| Annual Avg. 1976[3] | 168.4 | 160.93 |
| Annual Avg. 1977[3] | 192.0 | 179.03 |
| Annual Avg. 1978[3] | 198.5 | 190.04 |
| Annual Avg. 1979 | 248.8 | 196.34 |
| Annual Avg. 1980 | 321.8 | 218.00 |
| Annual Avg. 1981 | 355.3 | 237.34 |
| Aug 1981 | 360.9 | 154.1 R[2] |
| Sep 1981 | 358.4 | 155.0 R[2] |
| Oct 1981 | 352.5 | 155.6 R[2] |
| Nov 1981 | 351.3 | 157.5 R[2] |
| Dec 1981 | 349.9 | 167.4 R[2] |
| Jan 1982 | 354.9 | 169.0 R[2] |
| Feb 1982 | 356.7 | 170.4 R[2] |
| Mar 1982 | 360.3 | 170.7 R[2] |
| Apr 1982 | 367.7 | 170.7 R[2] |
| May 1982 | 367.6 | 171.2 R[2] |
| Jun 1982 | 367.2 | 172.4 R[2] |
| Jul 1982 | 369.1 | 176.3 R[2] |
| Aug 1982 | 371.5 | 176.8 R[2] |
| Sep 1982 | 374.0P | 177.0 R[2] |
| Oct 1982 | 377.2P | 177.1 P[2] |

P = Preliminary R = Revised since last month

[1] Australian Bureau of Statistics, Canberra: "Price Index of Materials Used in Manufacturing Industry" (Catalogue No. 6411.0), Table 3.

[2] Australian Bureau of Statistics, Canberra: "Wage Rates, Australia" (Catalogue No. 6312.0), Table 1. Figures are being converted to an Index number. As the data are converted, the new index numbers will be inserted.

[3] Monthly data for 1970 through 1978 appear on pages 4.7 and 4.8 of Nuexco Report 138.

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*GOVERNMENT STATISTICS*

## CANADA

| | Industry Selling Price Index: Manufacturing (D 500000)[1] [2] (1971 = 100.0) | Wage-earner Data: Average Hourly Earnings (C$)[3] [4] | | |
|---|---|---|---|---|
| | | Metal Mining, including Milling (SIC 050-059) | Primary Metal Industries, non-ferrous (SIC 296-298) | Chemicals and Chemical Products (SIC 370-379) |
| Annual Avg. 1978 | 190.4 | 8.76 | 6.82 | 6.97 |
| Annual Avg. 1979 | 217.9 | 9.60 | 7.35 | 7.67 |
| Annual Avg. 1980 | 247.2 | 10.59 | 8.05 | 8.50 |
| Annual Avg. 1981 | 288.4R | 12.02 | 9.03 | 9.53 |
| Nov 1981 | 278.8 | 12.89 | 9.45 | 9.89 |
| Dec 1981 | 280.0 | 12.87 | 9.42 | 10.03 |
| Jan 1982 | 281.9 | 13.14 | 9.53 | 10.11 |
| Feb 1982 | 283.5 | 13.25 | 9.60 | 10.19 |
| Mar 1982 | 284.8 | 13.34 | 9.62 | 10.35 |
| Apr 1982 | 287.7 | 13.46 | 9.79 | 10.48 |
| May 1982 | 288.8 | 13.56 | 9.88 | 10.62 |
| Jun 1982 | 289.7 | 13.71 | 9.92 | 10.69 |
| Jul 1982 | 290.3 | 13.71 | 10.05 | 10.73 |
| Aug 1982 | 290.1R | 13.80R | 10.03R | 10.80R |
| Sep 1982 | 292.3 | 14.19R | 10.18P | 10.71P |
| Oct 1982 | 292.0R | 13.84P | 10.17P | 10.78P |
| Nov 1982 | 291.0 | — | — | — |
| Dec 1982 | 292.3 | — | — | — |

P = Preliminary    R = Revised since last month

[1] Statistics Canada, Prices Division, Ottawa; "Industry Price Indexes" (Catalogue 62-011), Table 1. Indexes for the most recent six months shown are subject to revision.

[2] Monthly data for 1973 through 1978 appear on page 4.10 of Nuexco Report 138.

[3] Statistics Canada, Labour Division, Employment and Payrolls Section, Ottawa; "Employment, Earnings and Hours" (Catalogue 72-002), Table 2.

[4] Monthly data for 1977 and 1978 appear on page 4.11 of Nuexco Report 138.

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## REPUBLIC OF SOUTH AFRICA

| | Average Declared Working Costs per Metric Ton of Gold Ore Milled (Rand)[1] | Consumer Price Index[2] (1975 = 100, except where otherwise indicated) | Producer[5] Price Index All Groups (1975 = 100) | Total Employment in Mining and Quarrying (Code 35)[7] | Total Salaries and Wages in Mining and Quarrying (1,000 Rand) (Code 40)[7] |
|---|---|---|---|---|---|
| Annual Avg. 1971[3] | 7.88 | 106.4[4] | 59.1 | 652,294 | 415,956 |
| Annual Avg. 1972[3] | 8.79 | 113.3[4] | 63.9 | 623,067 | 443,933 |
| Annual Avg. 1973[3] | 10.51 | 124.1[4] | 72.3 | 684,743 | 572,133 |
| Annual Avg. 1974[3] | 13.18 | 138.5[4] | 85.3 | 674,140 | 761,596 |
| Annual Avg. 1975[3] | 16.71 | 157.2[4] | 100.0 | 639,473 | 1,003,617 |
| Annual Avg. 1976[3] | 19.30 | 174.7[4] | 115.1 | 671,240 | 1,212,983 |
| Annual Avg. 1977[3 6] | 23.87 | 194.4[4] | 130.0 | 712,006 | 1,420,670 |
| Annual Avg. 1978[3 6] | 27.14 | 137.2 | 142.7 | 664,571 | 1,537,169 |
| Annual Avg. 1979[3 6] | 30.18 | 155.3 | 164.5 | 692,209 | 1,830,632 |
| Annual Avg. 1980[6] | 35.53 | 176.7 | 192.1 | 714,379 | 2,279,615 |
| Annual Avg. 1981 | 41.89 | 206.5 | 218.3 | 728,506 | 2,820,505 |
| Jul 1981 | — | 204.6 | 218.4 | 735,839 | 249,080 |
| Aug 1981 | — | 208.0 | 222.6 | 722,684 | 245,817 |
| Sep 1981 | 43.28 | 211.6 | 224.6 | 724,604 | 251,502 |
| Oct 1981 | — | 213.4 | 227.0 | 717,918 | 248,159 |
| Nov 1981 | — | 214.8 | 229.4 | 720,255 | 253,044 |
| Dec 1981 | 44.52 | 216.3 | 230.4 | 709,612 | 257,655 |
| Jan 1982 | — | 217.6 | 233.1 | 700,375 | 257,173 |
| Feb 1982 | — | 220.2 | 236.8 | 705,992 | 250,191 |
| Mar 1982 | 45.49 | 225.2 | 237.4 | 725,700 | 262,210 |
| Apr 1982 | — | 228.9 | 241.9 | 707,502 | 252,562 |
| May 1982 | — | 230.3 | 244.8 | 715,162 | 258,770 |
| Jun 1982 | 45.77 | 232.1 | 246.7 | 707,552 | 261,361 |
| Jul 1982 | — | 234.1 | 249.4 | 702,141 | 283,248 |
| Aug 1982 | — | 236.8 | 253.4 | 705,562 | 276,730 |
| Sep 1982 | 48.04 | 241.0 | 255.0 | 704,490 | 281,331 |
| Oct 1982 | — | 243.9 | 260.1 | — | — |
| Nov 1982 | — | 245.4 | 262.5 | — | — |
| Dec 1982 | 49.62 | 246.2 | — | — | — |

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[1] Chamber of Mines of South Africa, Johannesburg; "Analysis of Working Results," published quarterly.

[2] Republic of South Africa Department of Statistics, Pretoria; "Government Gazette: Consumer Price Index for Urban Areas."

[3] Historical data for the Average Declared Working Costs and Consumer Price Index 1970-1979 appear on page 4.9 of Nuexco Report 140.

[4] April 1970 = 100.00.

[5] Previously known as the WHOLESALE PRICE INDEX, now the PRODUCER PRICE INDEX. The computation remains the same.

[6] Historical data for Codes 35 and 40 1977-1980 appear on page 28 of Nuexco Report 157.

[7] Bulletin of Statistics, Department of Statistics, Pretoria.

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## *GOVERNMENT STATISTICS*

### UNITED STATES

| | Producer Price Index—Industrial Commodities (1967 = 100)[1] | Producer Price Index—All Commodities (1967 = 100)[1] | Consumer Price Index (1967 = 100)[2] | GNP Implicit Price Deflator (1972 = 100)[3] | Gross Average Hourly Earnings of Production or Non-supervisory Workers (US$)[4] | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Metal Mining (SIC 10) | Primary Non-ferrous Metals (SIC 333) | Chemicals and Allied Products (SIC 28) | Electric and Electronic Equipment (SIC 36) |
| Annual Avg. 1972[5] | 117.9 | 119.1 | 125.3 | 100.00 | 4.56 | 4.59 | 4.26 | 3.71 |
| Annual Avg. 1973[5] | 125.9 | 134.7 | 133.1 | 105.75 | 4.84 | 4.98 | 4.51 | 3.91 |
| Annual Avg. 1974[5] | 153.8 | 160.1 | 147.7 | 115.08 | 5.44 | 5.63 | 4.88 | 4.21 |
| Annual Avg. 1975[5] | 171.5 | 174.9 | 161.2 | 125.79 | 6.13 | 6.24 | 5.39 | 4.64 |
| Annual Avg. 1976[5] | 182.4 | 183.0 | 170.5 | 132.34 | 6.76 | 6.87 | 5.91 | 4.96 |
| Annual Avg. 1977[5] | 195.1 | 194.2 | 181.5 | 140.05 | 7.28 | 7.67 | 6.43 | 5.39 |
| Annual Avg. 1978[5] | 209.4 | 209.3 | 195.4 | 150.42 | 8.23 | 8.56 | 7.02 | 5.82 |
| Annual Avg. 1979[5] | 236.5 | 235.6 | 217.4 | 163.42 | 9.27 | 9.50 | 7.60 | 6.32 |
| Annual Avg. 1980[5] | 274.8 | 268.8 | 246.8 | 178.64 | 10.26 | 10.63 | 8.30 | 6.94 |
| Annual Avg. 1981 | 304.1 | 293.4 | 272.4 | 195.51 | 11.55 | 11.98 | 9.12 | 7.62 |
| Annual Avg. 1982 | 312.3P | 299.3P | 289.1 | 207.23P | — | — | 9.98P | 8.17P |
| Dec 1981 | 310.0 | 295.8 | 281.5 | 201.55 | 12.08 | 12.45 | 9.53 | 7.90 |
| Jan 1982 | 311.7 | 298.2 | 282.5 | — | 12.19 | 12.66 | 9.68 | 7.98 |
| Feb 1982 | 311.4 | 298.5 | 283.4 | — | 12.22 | 12.61 | 9.68 | 7.96 |
| Mar 1982 | 311.0 | 298.0 | 283.1 | 203.68 | 12.29 | 12.69 | 9.71 | 8.01 |
| Apr 1982 | 309.9 | 298.0 | 284.3 | — | 12.23 | 12.68 | 9.81 | 8.03 |
| May 1982 | 309.6 | 298.6 | 287.1 | — | 12.25 | 12.71 | 9.83 | 8.05 |
| Jun 1982 | 310.6 | 299.3 | 290.6 | 205.98 | 12.26 | 12.91 | 9.95 | 8.09 |
| Jul 1982 | 312.8 | 300.4 | 292.2 | — | 12.23 | 12.91 | 10.02 | 8.18 |
| Aug 1982 | 313.2R | 300.2R | 292.8 | — | 12.29 | 12.97 | 10.03 | 8.24 |
| Sep 1982 | 312.9P | 299.5P | 293.3 | 208.51 | 12.53 | 13.46 | 10.20 | 8.31 |
| Oct 1982 | 314.4P | 299.9P | 294.1 | — | 12.50R | 13.22R | 10.24 | 8.34 |
| Nov 1982 | 315.1P | 300.4P | 293.6 | — | 12.57P | 13.32P | 10.26R | 8.38R |
| Dec 1982 | 315.0P | 300.6P | 292.4 | 210.73P | 12.71P | — | 10.36P | 8.46P |

P = Preliminary R = Revised since last month

[1] US Bureau of Labor Statistics, Washington, D.C.; "Producer Prices and Price Indexes," Table 6 (formerly "Wholesale Prices and Price Indexes"). Producer Price Indexes are revised four months after they are first released to reflect the availability of late reports and corrections by respondents.

[2] US Bureau of Labor Statistics, Washington, D.C.; Consumer Price Index for All Urban Consumers, US City Average, All Items.

[3] US Department of Commerce, Washington, D.C.; Bureau of Economic Analysis, National Income and Wealth Division; "Survey of Current Business," Table A. The GNP Implicit Price Deflator is published quarterly, and seasonally adjusted.

[4] US Bureau of Labor Statistics, Washington, D.C.; "Employment and Earnings," Table C-2. All data based on 1972 revision of SIC Manual. Data for 1970-1976 are adjusted to the March 1977 benchmark. Data for 1977-1978 are adjusted to the March 1979 benchmark. Data for January 1979 and beyond are adjusted to the March 1980 benchmark.

[5] Monthly data 1970-1978 for Producer Price Index-Industrial Commodities, Consumer Price Index, and Employment and Earnings SIC codes 10, 333, and 28, and quarterly data for GNP Implicit Price Deflator appear on pages 4.6-4.8 of Nuexco Report 139.
Monthly data 1977-1978 for Employment and Earnings SIC Codes 10, 333, and 28 appear on page 33 of Nuexco Report 147.
Monthly data 1970-1978 for Employment and Earnings SIC Code 36 appear on page 23 of Nuexco Report 154.
Monthly data 1979-1980 for Employment and Earnings, Revised Establishment Data, all listed codes, appear on page 22 of Nuexco Report 158.
Monthly data 1977-1980 for Producer Price Index-All Commodities, appear on page 21 of Nuexco Report 158.

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## Table 3A

## COST OF ENRICHED URANIUM (US $ per KgU as UF₆, 3 percent U₂₃₅) FOR VARIOUS COMBINATIONS OF FEED AND SWU COSTS (0.20% TA)

| Feed Cost (US $ per KgU as Natural UF₆) | SWU Price (US $ per SWU) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 90 | 95 | 100 | 105 | 110 | 115 | 120 | 125 | 130 |
| 40 | 606.75 | 628.29 | 649.82 | 671.35 | 692.88 | 714.42 | 735.95 | 757.48 | 779.01 |
| 45 | 634.15 | 655.68 | 677.22 | 698.75 | 720.28 | 741.81 | 763.35 | 784.88 | 806.41 |
| 50 | 661.55 | 683.08 | 704.61 | 726.15 | 747.68 | 769.21 | 790.74 | 812.28 | 833.81 |
| 55 | 688.95 | 710.48 | 732.01 | 753.54 | 775.08 | 796.61 | 818.14 | 839.67 | 861.20 |
| 60 | 716.34 | 737.88 | 759.41 | 780.94 | 802.47 | 824.01 | 845.54 | 867.07 | 888.60 |
| 65 | 743.74 | 765.27 | 786.81 | 808.34 | 829.87 | 851.40 | 872.93 | 894.47 | 916.00 |
| 70 | 771.14 | 792.67 | 814.20 | 835.73 | 857.27 | 878.80 | 900.33 | 921.86 | 943.40 |
| 75 | 798.53 | 820.07 | 841.60 | 863.13 | 884.66 | 906.20 | 927.73 | 949.26 | 970.79 |
| 80 | 825.93 | 847.46 | 869.00 | 890.53 | 912.06 | 933.59 | 955.13 | 976.66 | 998.19 |
| 85 | 853.33 | 874.86 | 896.39 | 917.93 | 939.46 | 960.99 | 982.52 | 1,004.06 | 1,025.59 |
| 90 | 880.73 | 902.26 | 923.79 | 945.32 | 966.86 | 988.39 | 1,009.92 | 1,031.45 | 1,052.99 |
| 95 | 908.12 | 929.66 | 951.19 | 972.72 | 994.25 | 1,015.79 | 1,037.32 | 1,058.85 | 1,080.38 |
| 100 | 935.52 | 957.05 | 978.59 | 1,000.12 | 1,021.65 | 1,043.18 | 1,064.72 | 1,086.25 | 1,107.78 |
| | 90 | 95 | 100 | 105 | 110 | 115 | 120 | 125 | 130 |
| 105 | 962.92 | 984.45 | 1,005.98 | 1,027.52 | 1,049.05 | 1,070.58 | 1,092.11 | 1,113.65 | 1,135.18 |
| 110 | 990.32 | 1,011.85 | 1,033.38 | 1,054.91 | 1,076.45 | 1,097.98 | 1,119.51 | 1,141.04 | 1,162.57 |
| 115 | 1,017.71 | 1,039.25 | 1,060.78 | 1,082.31 | 1,103.84 | 1,125.37 | 1,146.91 | 1,168.44 | 1,189.97 |
| 120 | 1,045.11 | 1,066.64 | 1,088.18 | 1,109.71 | 1,131.24 | 1,152.77 | 1,174.30 | 1,195.84 | 1,217.37 |
| 125 | 1,072.51 | 1,094.04 | 1,115.57 | 1,137.10 | 1,158.64 | 1,180.17 | 1,201.70 | 1,223.23 | 1,244.77 |
| 130 | 1,099.90 | 1,121.44 | 1,142.97 | 1,164.50 | 1,186.03 | 1,207.57 | 1,229.10 | 1,250.63 | 1,272.16 |
| 135 | 1,127.30 | 1,148.83 | 1,170.37 | 1,191.90 | 1,213.43 | 1,234.96 | 1,256.50 | 1,278.03 | 1,299.56 |
| 140 | 1,154.70 | 1,176.23 | 1,197.76 | 1,219.30 | 1,240.83 | 1,262.36 | 1,283.89 | 1,305.43 | 1,326.96 |
| 145 | 1,182.10 | 1,203.63 | 1,225.16 | 1,246.69 | 1,268.23 | 1,289.76 | 1,311.29 | 1,332.82 | 1,354.36 |
| 150 | 1,209.49 | 1,231.03 | 1,252.56 | 1,274.09 | 1,295.62 | 1,317.16 | 1,338.69 | 1,360.22 | 1,381.75 |
| 155 | 1,236.89 | 1,258.42 | 1,279.96 | 1,301.49 | 1,323.02 | 1,344.55 | 1,366.09 | 1,387.62 | 1,409.15 |
| 160 | 1,264.29 | 1,285.82 | 1,307.35 | 1,328.89 | 1,350.42 | 1,371.95 | 1,393.48 | 1,415.02 | 1,436.55 |

## OPTIMUM TAILS ASSAY FOR VARIOUS COMBINATIONS OF FEED AND SWU COSTS

(percent U₂₃₅)

| Feed Cost (US$ per KgU as Natural UF₆) | SWU Price (US $ per SWU) | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 90 | 95 | 100 | 105 | 110 | 115 | 120 | 125 | 130 | 138.65 | 140 | 149.85 | 160 | 170 | 180 | 190 | 200 |
| 40 | .316 | .322 | .327 | .333 | .338 | .343 | .347 | .352 | .356 | .363 | .364 | .372 | .379 | .385 | .391 | .397 | .402 |
| 45 | .302 | .308 | .314 | .320 | .325 | .330 | .334 | .339 | .343 | .350 | .351 | .359 | .366 | .373 | .379 | .384 | .390 |
| 50 | .291 | .297 | .302 | .308 | .313 | .318 | .323 | .327 | .332 | .339 | .340 | .347 | .354 | .361 | .367 | .373 | .379 |
| 55 | .280 | .286 | .292 | .297 | .302 | .307 | .312 | .317 | .321 | .328 | .329 | .337 | .344 | .351 | .357 | .363 | .368 |
| 60 | .271 | .277 | .282 | .288 | .293 | .298 | .302 | .307 | .311 | .319 | .320 | .327 | .334 | .341 | .347 | .353 | .359 |
| 65 | .262 | .268 | .273 | .279 | .284 | .289 | .294 | .298 | .302 | .310 | .311 | .318 | .326 | .332 | .339 | .345 | .350 |
| 70 | .254 | .260 | .265 | .271 | .276 | .281 | .285 | .290 | .294 | .301 | .302 | .310 | .317 | .324 | .330 | .336 | .342 |
| 75 | .246 | .252 | .258 | .263 | .268 | .273 | .278 | .282 | .287 | .294 | .295 | .302 | .310 | .316 | .323 | .329 | .334 |
| 80 | .239 | .245 | .251 | .256 | .261 | .266 | .271 | .275 | .279 | .287 | .288 | .295 | .302 | .309 | .316 | .322 | .327 |
| 85 | .233 | .239 | .244 | .249 | .254 | .259 | .264 | .268 | .273 | .280 | .281 | .288 | .296 | .302 | .309 | .315 | .321 |
| 90 | .227 | .232 | .238 | .243 | .248 | .253 | .258 | .262 | .266 | .274 | .275 | .282 | .289 | .296 | .302 | .308 | .314 |
| 95 | .221 | .227 | .232 | .237 | .242 | .247 | .252 | .256 | .260 | .268 | .269 | .276 | .283 | .290 | .296 | .302 | .308 |
| 100 | .216 | .221 | .227 | .232 | .237 | .242 | .246 | .251 | .255 | .262 | .263 | .270 | .278 | .284 | .291 | .297 | .302 |

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## Table 3B

## COST OF ENRICHED URANIUM (US $ per KgU as $UF_6$, 3 percent $U_{235}$) FOR VARIOUS COMBINATIONS OF FEED AND SWU COSTS (0.20% TA)

| Feed Cost (US $ per KgU as Natural $UF_6$) | SWU Price (US $ per SWU) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 138.65 | 140 | 149.85 | 160 | 170 | 180 | 190 | 200 |
| 40 | 816.26 | 822.08 | 864.50 | 908.21 | 951.27 | 994.34 | 1,037.40 | 1,080.47 |
| 45 | 843.66 | 849.48 | 891.89 | 935.60 | 978.67 | 1,021.73 | 1,064.80 | 1,107.86 |
| 50 | 871.06 | 876.87 | 919.29 | 963.00 | 1,006.07 | 1,049.13 | 1,092.20 | 1,135.26 |
| 55 | 898.46 | 904.27 | 946.69 | 990.40 | 1,033.46 | 1,076.53 | 1,119.59 | 1,162.66 |
| 60 | 925.85 | 931.67 | 974.09 | 1,017.80 | 1,060.86 | 1,103.93 | 1,146.99 | 1,190.06 |
| 65 | 953.25 | 959.06 | 1,001.48 | 1,045.19 | 1,088.26 | 1,131.32 | 1,174.39 | 1,217.45 |
| 70 | 980.65 | 986.46 | 1,028.88 | 1,072.59 | 1,115.66 | 1,158.72 | 1,201.79 | 1,244.85 |
| 75 | 1,008.84 | 1,013.86 | 1,056.28 | 1,099.99 | 1,143.05 | 1,186.12 | 1,229.18 | 1,272.25 |
| 80 | 1,035.44 | 1,041.26 | 1,083.67 | 1,127.39 | 1,170.45 | 1,213.51 | 1,256.58 | 1,299.64 |
| 85 | 1,062.84 | 1,068.65 | 1,111.07 | 1,154.78 | 1,197.85 | 1,240.91 | 1,283.98 | 1,327.04 |
| 90 | 1,090.24 | 1,096.05 | 1,138.47 | 1,182.18 | 1,225.24 | 1,268.31 | 1,311.37 | 1,354.44 |
| 95 | 1,117.63 | 1,123.45 | 1,165.87 | 1,209.58 | 1,252.64 | 1,295.71 | 1,338.77 | 1,381.84 |
| 100 | 1,145.03 | 1,150.85 | 1,193.26 | 1,236.97 | 1,280.04 | 1,323.10 | 1,366.17 | 1,409.23 |
| | 138.65 | 140 | 149.85 | 160 | 170 | 180 | 190 | 200 |
| 105 | 1,172.43 | 1,178.24 | 1,220.66 | 1,264.37 | 1,307.44 | 1,350.50 | 1,393.57 | 1,436.63 |
| 110 | 1,199.83 | 1,205.64 | 1,248.06 | 1,291.77 | 1,334.83 | 1,377.90 | 1,420.96 | 1,464.03 |
| 115 | 1,227.22 | 1,233.04 | 1,275.46 | 1,319.17 | 1,362.23 | 1,405.30 | 1,448.36 | 1,491.43 |
| 120 | 1,254.62 | 1,260.43 | 1,302.85 | 1,346.56 | 1,389.63 | 1,432.69 | 1,475.76 | 1,518.82 |
| 125 | 1,282.02 | 1,287.83 | 1,330.25 | 1,373.96 | 1,417.03 | 1,460.09 | 1,503.16 | 1,546.22 |
| 130 | 1,309.41 | 1,315.23 | 1,357.65 | 1,401.36 | 1,444.42 | 1,487.49 | 1,530.55 | 1,573.62 |
| 135 | 1,336.81 | 1,342.63 | 1,385.04 | 1,428.76 | 1,471.82 | 1,514.88 | 1,557.95 | 1,601.01 |
| 140 | 1,364.21 | 1,370.02 | 1,412.44 | 1,456.15 | 1,499.22 | 1,542.28 | 1,585.35 | 1,628.41 |
| 145 | 1,391.61 | 1,397.42 | 1,439.84 | 1,483.55 | 1,526.61 | 1,569.68 | 1,612.74 | 1,655.81 |
| 150 | 1,419.00 | 1,424.82 | 1,467.24 | 1,510.95 | 1,554.01 | 1,597.08 | 1,640.14 | 1,683.21 |
| 155 | 1,446.40 | 1,452.21 | 1,494.63 | 1,538.34 | 1,581.41 | 1,624.47 | 1,667.54 | 1,710.60 |
| 160 | 1,473.80 | 1,479.61 | 1,522.03 | 1,565.74 | 1,608.81 | 1,651.87 | 1,694.94 | 1,738.00 |

## OPTIMUM TAILS ASSAY FOR VARIOUS COMBINATIONS OF FEED AND SWU COSTS

(percent $U_{235}$)

| Feed Cost (US$ per KgU as Natural $UF_6$) | SWU Price (US $ per SWU) | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 90 | 95 | 100 | 105 | 110 | 115 | 120 | 125 | 130 | 138.65 | 140 | 149.85 | 160 | 170 | 180 | 190 | 200 |
| 105 | .211 | .216 | .222 | .227 | .232 | .236 | .241 | .245 | .250 | .257 | .258 | .265 | .272 | .279 | .285 | .291 | .297 |
| 110 | .206 | .211 | .217 | .222 | .227 | .231 | .236 | .240 | .245 | .252 | .253 | .260 | .267 | .274 | .280 | .286 | .292 |
| 115 | .201 | .207 | .212 | .217 | .222 | .227 | .231 | .236 | .240 | .247 | .248 | .255 | .262 | .269 | .275 | .281 | .287 |
| 120 | .197 | .202 | .208 | .213 | .218 | .222 | .227 | .231 | .235 | .242 | .243 | .250 | .258 | .264 | .271 | .277 | .282 |
| 125 | .193 | .198 | .204 | .209 | .213 | .218 | .222 | .227 | .231 | .238 | .239 | .246 | .253 | .260 | .266 | .272 | .278 |
| 130 | .189 | .194 | .200 | .205 | .209 | .214 | .218 | .223 | .227 | .234 | .235 | .242 | .249 | .256 | .262 | .268 | .273 |
| 135 | .185 | .191 | .196 | .201 | .205 | .210 | .214 | .219 | .223 | .230 | .231 | .238 | .245 | .251 | .258 | .264 | .269 |
| 140 | .182 | .187 | .192 | .197 | .202 | .206 | .211 | .215 | .219 | .226 | .227 | .234 | .241 | .247 | .254 | .260 | .265 |
| 145 | .178 | .184 | .189 | .194 | .198 | .203 | .207 | .211 | .215 | .222 | .223 | .230 | .237 | .244 | .250 | .256 | .261 |
| 150 | .175 | .180 | .185 | .190 | .195 | .199 | .204 | .208 | .212 | .218 | .219 | .227 | .234 | .240 | .246 | .252 | .258 |
| 155 | .172 | .177 | .182 | .187 | .192 | .196 | .200 | .204 | .208 | .215 | .216 | .223 | .230 | .237 | .243 | .248 | .254 |
| 160 | .169 | .174 | .179 | .184 | .188 | .193 | .197 | .201 | .205 | .212 | .213 | .220 | .227 | .233 | .239 | .245 | .251 |

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# NUEXCO REPORT 174
## EXECUTIVE SUMMARY

**1982 Annual Review: Part 2 of 2**

Part 2 of Nuexco's **Annual Review** features a review of price behavior in 1982 for secondary market SWU and a discussion of the development of a viable international secondary market for spot sales of enrichment services. It also reviews important market developments relative to Africa, Australia, Europe and the Far East.

**Exchange Value Rose \$1.25, to \$21.50**

The **Exchange Value** as of January 31, 1983 is **\$21.50** per pound $U_3O_8$. Five uranium sales are reported, involving approximately 2.5 million pounds $U_3O_8$, *equivalent*. Two of the five transactions involved $UF_6$ and a third involved *enriched* $UF_6$.

**Near-Term Supply-Demand Ratio is 2.0:1**

**Active** spot and near-term **uranium** supply amounts to **9.4** million pounds $U_3O_8$, up 7 percent from last month. **Active** spot and near-term **uranium demand** rose to **4.7** million pounds $U_3O_8$, up 20 percent from last month. Therefore, the spot and near-term **supply-demand ratio** dropped slightly, to **2.0:1**.

**Transaction Value Rose \$0.55, to \$19.35**

The **Transaction Value** as of January 31, 1983 is **19.35** per pound $U_3O_8$. It includes 12 transactions involving a total of 5.4 million pounds $U_3O_8$ and covers a period of three months.

**Conversion Value Down \$0.25, to \$1.20**

The **Conversion Value** as of January 31, 1983 is **\$1.20** per pound U as $UF_6$, down \$0.25 since last month. No conversion transactions are reported. Active sellers are offering 3.3 million pounds U in near-term conversion services, up approximately 25 percent since last month. Active demand remained at 220 thousand pounds U. A total of 10-15 million pounds U of conversion services could become available in the coming months from six sources, located both in Europe and the US.

**Loan Use Charge Rate Steady at 6 Percent**

The **Loan Use Charge Rate** as of January 31, 1983 is **6 percent** per annum. No transactions are reported. This segment of the market is very quiet.

**Enriched Uranium and SWUs**

Although a number of 3.5-year DOE requirements contract holders are seeking secondary market supplies for FY 1983, Nuexco is not presently aware of any DOE sellers willing to offer prices low enough to make contract terminations attractive. There are, however, large quantities of Eurodif SWU being offered at discounts of approximately \$35 from DOE's AFC price. The prevailing discount for DOE FY 1983 SWU remains at approximately \$25 from the AFC price. Sellers of DOE SWU for delivery in FY 84 continue to offer discounts of \$28-\$30 from DOE's AFC price (at .2 tails). The market for DOE SWU for FY 1985 and later has virtually disappeared while potential sellers await DOE's announcement of the terms and conditions of conversion to the FR contract.

**Raw Materials**

Omitted this month to save space.

**1982 Index**

Lists references to articles which appeared in Reports 162-172. (The 1983 Index will cover Reports 173-184.)

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## NUEXCO REPORT 174
## FIGURES OF THE MONTH

(Referenced to January 31, 1983)

| | This Month | Last Month | 12 Months Ago |
|---|---|---|---|
| Exchange Value[1] | 21.50 | 20.25 | 23.00 |
| Transaction Value[1] | 19.35 | 18.80 | 24.00 |
| Conversion Value[2] | 1.20 | 1.45 | 1.20 |
| Loan Use Charge Rate[3] | 6% | 6% | 6% |
| Near-Term Uranium Supply[4] | 9.4 | 8.8 | 10.1 |
| Near-Term Uranium Demand[5] | 4.7 | 3.9 | 4.0 |
| Near-Term Supply-Demand Ratio | 2.0 | 2.3 | 2.5 |
| Current Transactions[6]: | | | |
| Number of Transactions | 5 | 9 | 3 |
| Quantity of Material[7] | 1.5-2.8 | 8.7-22.4 | 0.3-0.9 |
| USDOE SWU Prices[8]: | | | |
| AFC | 138.65 | 138.65 | 130.75 |
| Requirements | 149.85 | 149.85 | 138.37 |
| Optimum Tails Assay[9] | .321 | .327 | .308 |
| Calculated Price of Enriched $UF_6$[10] [11]: | | | |
| 2.5 w/o $U_{235}$ | 711.17 | 698.99 | 703.19 |
| 3.0 w/o $U_{235}$ | 917.87 | 903.04 | 905.18 |
| 3.5 w/o $U_{235}$ | 1,128.71 | 1,111.24 | 1,111.09 |
| 4.0 w/o $U_{235}$ | 1,342.62 | 1,322.50 | 1,319.88 |

---

[1] US $ per pound $U_3O_8$ equivalent
[2] US $ per pound U as $UF_6$
[3] Per annum
[4] Active inquiries to sell, for delivery within 12 months after contract signing (millions of pounds $U_3O_8$)
[5] Active inquiries to purchase, for delivery within 12 months after contract signing (millions of pounds $U_3O_8$)
[6] Uranium transactions only; does not include loans, conversion, or SWU transactions
[7] Millions of pounds $U_3O_8$, equivalent
[8] US $ per SWU
[9] Percent $U_{235}$.
[10] Theoretical calculation based on Exchange Value, Conversion Value, 0.20 percent tails assay and the USDOE price for AFC SWUs.
[11] US $ per KgU as $UF_6$

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**MARCH 1983** **NUMBER 175**

# Monthly Report on the Nuclear Fuel Market

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# NUEXCO REPORT 175
# EXECUTIVE SUMMARY

**Exchange Value Rose**
**$0.25, to $21.75**

The **Exchange Value** as of February 28, 1983 is **21.75** per pound $U_3O_8$. Five uranium sales are reported, involving approximately 1.1 million pounds $U_3O_8$, *equivalent*. One of the five transactions involved natural $UF_6$, and one involved *enriched* $UF_6$.

**Near-term Supply-Demand**
**Ratio Rose to 3.1:1**

Active spot and near-term **uranium supply** amounts to ***8.6 million*** pounds $U_3O_8$ *equivalent*, down 9% from last month. **Active** spot and near-term **uranium demand** dropped to **2.8 million** pounds $U_3O_8$ equivalent, down 40% from last month. Therefore, the spot and near-term **supply-demand ratio** rose 50 percent, to **3.1:1**.

**Transaction Value Rose**
**$0.65, to $20.00**

The **Transaction Value** as of February 28, 1983 is **$20.00** per pound $U_3O_8$. It includes 11 transactions involving a total of 4.2 million pounds $U_3O_8$ and covers a period of three months.

**Conversion Value Rose**
**$0.20, to $1.40**

The **Conversion Value** as of February 28, 1983 is **$1.40** per pound U as $UF_6$, up 20 cents since last month. No conversion transactions are reported. Active sellers are offering 2.6 million pounds U in near-term conversion services, down 20% since last month. Active demand rose to 920 thousand pounds U.

**Loan Use Charge Rate**
**Steady at 6%**

The **Loan Use Charge Rate** as of February 28, 1983 is **6 percent** per annum. No loan transactions are reported. This segment of the market is very quiet.

**Nuexco Introduces**
**SWU Value**

This Report introduces the Nuexco SWU Value, Nuexco's judgment of the price, expressed in US $ per SWU, at which transactions for the sale of significant quantities of SWU of any origin for delivery in the specified DOE fiscal year could be concluded as of the last day of the month.

**SWU Values:**
**FY 83 $103**
**FY 84 $110**

As of February 28, 1983, the **SWU Value for FY83** is **$103 per SWU** and the **SWU Value for FY84** is **$110**. Those prices reflect the dominance of the market by sellers of large quantities of Eurodif SWUs, who are offering substantial discounts at high tails assays. Prices offered by those few sellers of DOE SWU remaining in the market are approximately $115 per SWU (referenced to .2 tails and 3% enrichment). The only potential buyers for significant quantities of FY83 SWU on the secondary market are holders of DOE requirements contracts having 3.5-year termination provisions. A few buyers seeking to purchase small quantities of SWU above their contract amounts will have to pay significantly more than the FY83 SWU Value, due to the small lot size.

For FY84 SWUs, there is no large differential between prices being offered by sellers of DOE and Eurodif SWUs. The market for FY85 and beyond remains quiet, awaiting DOE's revelation of the terms and conditions of conversion to the FR contract.

**Raw Materials**

Discusses the Crow Butte Uranium Deposit.

**Recent Developments**

Features items of interest on South Africa, Australia, Europe, Japan, Taiwan and the US.

*This Executive Summary may be reproduced for internal distribution.*

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# NUEXCO REPORT 175
# FIGURES OF THE MONTH
(Referenced to February 28, 1983)

| | This Month (Report 175) | Last Month (Report 174) | 12 Months Ago (Report 163) |
|---|---|---|---|
| Exchange Value[1] | 21.75 | 21.50 | 23.00 |
| Transaction Value[1] | 20.00 | 19.35 | 23.70 |
| Conversion Value[2] | 1.40 | 1.20 | 1.20 |
| Loan Use Charge Rate[3] | 6% | 6% | 6% |
| Near-Term Uranium Supply[4] | 8.6 | 9.4 | 10.9 |
| Near-Term Uranium Demand[5] | 2.8 | 4.7 | 3.3 |
| Near-Term Supply-Demand Ratio | 3.1 | 2.0 | 3.3 |
| Current Transactions[6]: | | | |
| Number of Transactions | 5 | 5 | 4 |
| Quantity of Material[7] | 0.8-1.8 | 1.5-2.8 | 1.3-2.5 |
| SWU Prices[8]: | | | |
| Nuexco SWU Values: | | | |
| FY 83 | 103 | — | — |
| FY 84 | 110 | — | — |
| USDOE SWU Prices: | | | |
| AFC | 138.65 | 138.65 | 130.75 |
| Requirements | 149.85 | 149.85 | 138.37 |
| Market Value of Enriched $UF_6$[9, 10]: | | | |
| 2.5 w/o $U_{235}$ | 600.94 | 711.17 | 703.19 |
| 3.0 w/o $U_{235}$ | 770.28 | 917.87 | 905.18 |
| 3.5 w/o $U_{235}$ | 942.70 | 1,128.71 | 1,111.09 |
| 4.0 w/o $U_{235}$ | 1,117.40 | 1,342.62 | 1,319.88 |

---

[1] US $ per pound $U_3O_8$ equivalent

[2] US $ per pound U as $UF_6$

[3] Per annum

[4] Active inquiries to sell, for delivery within 12 months after contract signing (millions of pounds $U_3O_8$)

[5] Active inquiries to purchase, for delivery within 12 months after contract signing (millions of pounds $U_3O_8$)

[6] Uranium transactions only; does not include loans, conversion, or SWU transactions

[7] Millions of pounds $U_3O_8$, equivalent

[8] US $ per SWU

[9] Calculated using the Nuexco Exchange Value, Conversion Value, and 0.20 percent tails assay. Calculations before 2/28/83 used the USDOE price for AFC SWUs. As of 2/28/83, calculations use the Nuexco SWU Value for the relevant fiscal year (currently FY 83).

[10] US $ per KgU as $UF_6$

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# MONTHLY REPORT ON THE URANIUM MARKET

March 1983 No. 175

R. WESLEY MILLER, *EDITOR*

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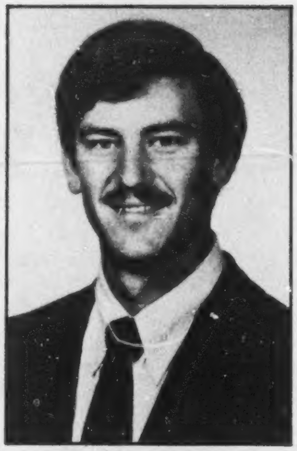
## *FOREWORD*



Nuexco will host a hospitality suite during the Atomic Industrial Forum's Fuel Cycle Conference '83. The suite will be at the Westin Crown Center in Kansas City, Missouri, March 20-23. The suite number will be posted in the hotel lobby on Sunday afternoon. We look forward to seeing you in Kansas City.

* * *

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* * *

Nuexco passed another milestone on February 28, when Mrs. Elizabeth Bryant retired. Betty, as she was known to many of our customers, joined the Company in 1971 as secretary to Mr. George White, Sr., who was then president. She continued in that capacity following Mr. White's retirement in 1976.

Betty is a rare person whose work and personal character have been admired by all. We like to think of her as representing the best of Nuexco. She will be missed by her associates, all of whom wish her well in this new step in life.

Mr. Wolcott's new secretary is Mrs. Kathie Kuziel, known to most of our subscribers and friends as the able young lady who manages Nuexco's hospitality suites, luncheons and other functions.

## NATURAL URANIUM AND CONVERSION

The **Exchange Value** as of February 28, 1983 rose for the fifth consecutive month, to **$21.75** per pound $U_3O_8$, up $0.25 since last month. The sustained buying activity of the past six months diminished further. The *Current Market Data* section lists five uranium sales, covering a total of approximately 1.1 million pounds $U_3O_8$ *equivalent*. Three of the transactions involved uranium concentrates ($U_3O_8$), one involved natural uranium hexafluoride ($UF_6$), and one involved enriched $UF_6$.

**Active spot and near-term supply** of uranium (material offered at competitive prices, terms and other conditions) amounts to **8.6** million pounds $U_3O_8$, equivalent, down 9 percent from last month's level of 9.4 million. **Active spot and near-term demand** dropped to **2.8** million pounds $U_3O_8$ equivalent, down 40 percent from last month. Therefore, the spot and near-term **supply-demand ratio** rose 50 percent, to **3.1:1.**

* * *

The **Transaction Value** as of February 28, 1983 is **$20.00** per pound $U_3O_8$, up $0.65 from a month ago. The current Transaction Value includes 11 transactions involving a total of 4.2 million pounds $U_3O_8$ equivalent, and covers a period of three months.

* * *

The **Conversion Value** as of February 28, 1983 is **$1.40** per pound U as $UF_6$, up $0.20 from last month. **Active inquiries to sell** conversion services within one year total **2.6** million pounds U, down approximately 20 percent since last month. **Active inquiries to buy** conversion services within one year rose to **920 thousand** pounds U as $UF_6$. There are no conversion transactions reported this month.

* * *

The **Loan Use Charge Rate** remained at six percent per annum. The limited activity in the market is taking place at or near that level, but there are few participants. No loan transactions are reported this month.

* * *

The Exchange Value edged upward this month to another 25 cents per pound $U_3O_8$. There are at least four sellers willing to discuss sales of one million pounds $U_3O_8$ or more at current price levels. An upward trend seen during February lost some of its momentum and leveled off toward the end of the month as transactions were completed. The $U_3O_8$ market is still characterized by the unusually wide price distribution noted last month.

The Conversion Value's upward movement was due to the emergence of a new block of active demand and to the withdrawal from the secondary market of one aggressive seller's large quantity of conversion services. The remaining sellers have all indicated their willingness to discuss transactions at current price levels. This market is characterized by very small numbers of sellers and, especially, buyers. As such, it remains vulnerable to extreme price movements in either direction; such price movements could be triggered by the actions of any one of numerous market participants.

## THE SWU VALUE

Beginning this month, Nuexco will publish one or more secondary market spot prices for enrichment services. The **SWU Value** represents Nuexco's judgment as to the price at which transactions for enrichment services, *for the specified DOE fiscal year*, could be concluded as of the end of the month. The complete definition and derivation are reprinted in the following paragraphs, but three qualifications are in order:

1. Although Nuexco has designed the definition to respond to changes in market conditions and the quantity and quality of information available, the SWU Value is determined by means of a combination of objective data and the subjective judgment of Nuexco's senior staff. It describes, by means of spot price, the state of the secondary SWU market as of the last day of the month.
2. The current excess of supply over demand has led to a situation in which secondary market SWU prices and the SWU Value are lower than the contractual purchase prices of most SWU sellers. The SWU Value *in no way* relates to historical costs or to the price level needed to provide a minimum acceptable rate of return on investment.
3. Nuexco will be publishing the SWU Value(s) each month, only for those USDOE fiscal years for which firm prices are available, usually the current fiscal year and the next.

### Definition

The SWU (Separative Work Unit) Value is Nuexco's judgment of the price, expressed in US dollars per SWU, at which transactions for the sale of significant quantities of SWU of any origin for delivery in the specified DOE fiscal year could be concluded as of the last day of the month.

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*PRICING*

**Derivation**

Nuexco bases the SWU Value upon:

A. Data from recently completed transactions

B. Data from pending transactions

C. Firm bids to buy and firm offers to sell

D. Prices purchasers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy, and prices sellers have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell.

E. SWU prices at varying tails assays and varying product assays are converted to the equivalent SWU price at the DOE Reference Transaction Tails Assay (presently 0.20 weight percent $U_{235}$) and a product assay of three percent $U_{235}$ assuming feed costs calculated using the Nuexco Exchange Value and Nuexco Conversion Value determined as of the last day of the same month.

**Comments**

Nuexco does not consider the following in determining the SWU Value:

A. The price of SWU delivered under long-term contracts from primary suppliers, such as DOE, Urenco, or Eurodif.

B. The price of SWU delivered under other than arm's length transactions.

**Evolution of the Secondary SWU Market**

The secondary market for enrichment services has undergone a fundamental change during the past few years. From a limited market characterized by assignments of Fixed-Commitment contracts from one US DOE customer to another, it has developed into a truly worldwide secondary market. Utilities are making use of the secondary SWU market as an integral part of their overall fuel procurement strategies, much as they have been using the spot markets for conversion services and natural uranium. Many have expressed hope that the secondary SWU market remains active for the long term.

Many of the factors driving this market are the same as those driving the $U_3O_8$ and conversion markets. Over-optimistic demand projections, contracting far in advance of need, reactor cancellations and deferrals, supply overcapacity, inventory accumulation, and high carrying costs combined to produce in many market participants a strong desire to sell excess inventories and obligations. Thus, the growing interest in the secondary market for enrichment services has led to increases in both market opportunities and completed transactions.

By the beginning of 1980, the market for new reactor orders had virtually ceased to exist, so few new enrichment contracts were being signed and the market for assignments of complete enrichment contracts vanished. Moreover, continual reactor cancellations and construction delays caused more and more SWU to become available in the near term. As sellers increased discount levels to stimulate demand, buyers and sellers began communicating more openly and more actively with one another.

Reactor delays and cancellations continued to aggravate the oversupply condition on the secondary market. More open exchange of information enabled the market to respond in classic fashion; prices dropped enough to make it profitable for holders of DOE requirements contracts having 3.5-year termination provisions to use secondary market SWU purchases to replace existing commitments. By the end of 1982, certain of those customers had become willing to cancel their DOE contracts *long term*, without first buying replacement SWUs, thereby depending on the secondary market for future services. At this point, it could be said that a truly worldwide secondary market had developed. (Last month's Report #174 discusses the development of the secondary SWU market in greater detail.)

**Implications for the Fuel Buyer**

When the Nuexco SWU Value for FY83 rather than the DOE price for AFC SWUs is used to calculate the marginal cost of enriched uranium, the cost is 16-17 percent lower. Table 1 shows a comparison of the two calculations for product assays ranging from 2.5 percent to 4.0 percent. Both calculations use Nuexco's Exchange Value and Conversion Value and assume a tails assay of 0.2 percent $U_{235}$.

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### Table 1

### MARGINAL COST[1] OF ENRICHED $UF_6$ ($/Kg U)

| Percent $U_{235}$ | Using DOE Price for AFC SWUs | Using Nuexco SWU Value for FY83 | Difference | Percent Difference |
|---|---|---|---|---|
| 2.5 | $716.05 | $600.94 | $115.11 | 16 |
| 3.0 | $923.81 | $770.28 | $153.53 | 17 |
| 3.5 | $1,135.71 | 942.70 | $193.01 | 17 |
| 4.0 | $1,350.68 | $1,117.40 | $233.28 | 17 |

[1] **Calculated using 0.2% tails assay, Nuexco Exchange Value and Nuexco Conversion Value as of 2/28/83.**

## ENRICHED URANIUM AND SWUs

The **SWU Value for FY 1983 is $103.00 per SWU.** This price reflects the dominance of the market by large scale Eurodif sellers who are offering significant discounts at high tails assays for large blocks of SWU. In contrast, most aggressive sellers of DOE FY 1983 SWUs, those having the advantage of holding high tails assays, have already sold out and have withdrawn from the market. Prices offered by those DOE sellers still remaining are presently about $115 per SWU at .2 tails. Under those conditions, there is no economic incentive for a DOE customer to terminate on short notice and replace with DOE SWUs.

The only potential buyers of significant size for FY 1983 are holders of DOE requirements contracts having 3.5-year termination provisions, who would have to terminate before buying replacement SWU on the secondary market. These buyers may choose either to purchase Eurodif SWU or retain their requirements contract deliveries. There are in addition a few small buyers who are seeking SWU above their requirements contract ceilings. These buyers will have to pay prices significantly above the FY 1983 Value due to the lack of interest among Eurodif sellers in selling small blocks of SWU.

The **SWU Value for FY 1984** is **$110 per SWU**. Prices in this range are being offered by both Eurodif and DOE SWU sellers. There is no large differential between the price offered by DOE and Eurodif sellers as there is for 1983, since there remains available for 1984 a large surplus of both Eurodif and DOE SWU at high tails assays. Demand for 1984 SWU should increase substantially in the next few months as a number of DOE requirements contract holders, previously unwilling to terminate and commit to secondary market supplies until reactor schedules become more firm, begin entering the market.

The market for FY 1985 SWU and later remains quiet as potential DOE sellers await DOE's announcement of the terms and conditions of conversion to the FR contract. There is some Eurodif material available for long-term delivery at fixed prices, but there has been little interest in such offers among buyers.

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*CURRENT MARKET DATA*

**EXCHANGE VALUE $21.75/lb. $U_3O_8$**
Determined as of February 28, 1983

**Definition**[1]

The Exchange Value is Nuexco's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the last day of the month.

**Derivation**

Nuexco bases the Exchange Value upon:

A. Data from recently completed transactions.
B. Data from pending transactions.
C. Firm bids to buy and firm offers to sell.
D. Prices purchasers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy, and prices sellers have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell.

**Comments**

Nuexco does not consider the following in determining the Exchange Value:

A. The price of uranium delivered or to be delivered under old contracts.
B. The price of uranium delivered in connection with contract renegotiations or other than arm's length transactions.

---

[1] In December, 1981, Nuexco published a history of the Exchange Value which chronicled, month-by-month, changes in its definition, usage and derivation. Copies are available upon request.

**TRANSACTION VALUE**[2]
Determined as of February 28, 1983

| $/lb. $U_3O_8$ | Millions of Pounds | Number of Transactions | Number of Months |
|---|---|---|---|
| 20.00 | 4.2 | 11 | 3 |

**Definition**

The Transaction Value is a weighted average price of recent transactions, and is based on prices paid for $U_3O_8$ in transactions closed within the previous three-month period and for which delivery was scheduled within one year of the transaction date. At least ten transactions totaling at least two million pounds $U_3O_8$ are included in each calculation, or the sample time is extended as necessary to include these minima. Foreign currencies are converted to US dollars as of the transaction date.

**Comments**

Nuexco does not consider the following in determining the Transaction Value:

A. The price of uranium delivered in connection with contract renegotiations or other than arm's length transactions.
B. The price of uranium delivered in connection with contracts which call for "market price" mechanisms. This exclusion applies particularly to contracts in which delivery prices are expressed as a function of Exchange Value or any other independent variable. Also excluded from consideration are all data where the delivery price is defined in such a way that it cannot currently be determined.

---

[2] Transaction Values for 1976 through 1981 and their associated parameters (millions of pounds, number of transactions and number of months) are tabulated on pages 31 and 32 of Report 161. Corresponding data for 1982 are tabulated on page 5 of Report 173.

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## CONVERSION VALUE[1] $1.40/lb. U as $UF_6$
Determined as of February 28, 1983

**Definition**

The Conversion Value is Nuexco's judgment of the price at which spot and/or near-term transactions for significant quantities of conversion services could be concluded in the secondary market as of the last day of the month.

**Derivation**

Nuexco bases the Conversion Value upon:

A. Data from recently completed transactions.
B. Data from pending transactions.
C. Firm bids to buy and firm offers to sell.
D. Prices purchasers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy, and prices sellers have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell.

**Comments**

Nuexco does not consider the following in determining the Conversion Value:

A. The price of conversion services delivered or to be delivered under old contracts.
B. The price of conversion services delivered in connection with contract renegotiations or other than arm's length transactions.

[1] Monthly data for 1981 and 1982 are tabulated on page 6 of Report 173.

## LOAN USE CHARGE RATE[2] 6%
Determined as of February 28, 1983

**Definition**

The Loan Use Charge Rate is Nuexco's judgment of the annual interest rate at which uranium loans could be concluded as of the last day of the month.

**Derivation**

Nuexco bases the Loan Use Charge Rate upon:

A. Data from recently completed or pending loan transactions.
B. Rates included in firm proposals to borrow or lend.
C. Rates that potential borrowers and lenders have expressed as a willingness to pay or accept, but for which Nuexco is not aware of firm proposals.

[2] Monthly data for 1968 through 1981 appear on pages 32-34 of Report 162. Monthly data for 1982 appear on page 2 of Report 173.

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*CURRENT MARKET DATA*

**SWU VALUE $103/SWU for FY83**
**SWU VALUE $110/SWU for FY84**
Determined as of February 28, 1983

**Definition**

The SWU (Separative Work Unit) Value is Nuexco's judgment of the price, expressed in US dollars per SWU, at which transactions for the sale of significant quantities of SWU of any origin for delivery in the specified DOE fiscal year could be concluded as of the last day of the month.

**Derivation**

Nuexco bases the SWU Value upon:

A. Data from recently completed transactions.
B. Data from pending transactions.
C. Firm bids to buy and firm offers to sell.
D. Prices purchasers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy, and prices sellers have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell.
E. SWU prices at varying tails assays and varying product assays are converted to the equivalent SWU price at the DOE Reference Transaction Tails Assay (presently 0.20 weight percent $U_{235}$) and a product assay of three percent $U_{235}$ assuming feed costs calculated using the Nuexco Exchange Value and Nuexco Conversion Value determined as of the last day of the same month.

**Comments**

Nuexco does not consider the following in determining the SWU Value:

A. The price of SWU delivered under long-term contracts from primary suppliers, such as DOE, Urenco, or Eurodif.
B. The price of SWU delivered under other than arm's length transactions.

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## EXCHANGE VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

| Country (currency) | per lb. $U_3O_8$ in Concentrates | per kg $U_3O_8$ in Concentrates | per kg U in Concentrates |
|---|---|---|---|
| Australia (dollar) | 22.63 | 49.89 | 58.83 |
| Belgium (comm. franc) | 1,031 | 2,273 | 2,680 |
| Canada (dollar) | 26.70 | 58.87 | 69.42 |
| Finland (markka) | 116.94 | 257.80 | 304.01 |
| France (franc) | 148.87 | 328.20 | 387.03 |
| FRG (Deutschmark) | 52.41 | 115.54 | 136.25 |
| Italy (lira) | 30,208 | 66,598 | 78,535 |
| Japan (yen) | 5,106 | 11,256 | 13,274 |
| Netherlands (guilder) | 57.97 | 127.80 | 150.71 |
| South Africa (rand) | 23.45 | 51.69 | 60.95 |
| Spain (peseta) | 2,825 | 6,227 | 7,344 |
| Sweden (krona) | 161.23 | 355.45 | 419.16 |
| Switzerland (franc) | 44.09 | 97.20 | 114.63 |
| UK (pound) | 14.23 | 31.36 | 36.98 |
| US (dollar) | 21.75 | 47.95 | 56.55 |

## TRANSACTION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

| Country (currency) | per lb. $U_3O_8$ in Concentrates | per kg $U_3O_8$ in Concentrates | per kg U in Concentrates |
|---|---|---|---|
| Australia (dollar) | 20.81 | 45.88 | 54.10 |
| Belgium (comm. franc) | 947.87 | 2,090 | 2,464 |
| Canada (dollar) | 24.55 | 54.13 | 63.84 |
| Finland (markka) | 107.53 | 237.06 | 279.55 |
| France (franc) | 136.89 | 301.80 | 355.89 |
| FRG (Deutschmark) | 48.19 | 106.25 | 125.29 |
| Italy (lira) | 27,778 | 61,239 | 72,216 |
| Japan (yen) | 4,695 | 10,350 | 12,206 |
| Netherlands (guilder) | 53.30 | 117.52 | 138.58 |
| South Africa (rand) | 21.56 | 47.53 | 56.05 |
| Spain (peseta) | 2,597 | 5,726 | 6,753 |
| Sweden (krona) | 148.26 | 326.85 | 385.44 |
| Switzerland (franc) | 40.54 | 89.38 | 105.40 |
| UK (pound) | 13.08 | 28.84 | 34.01 |
| US (dollar) | 20.00 | 44.09 | 52.00 |

[1] Calculated using currency exchange rates published in the Wall Street Journal on February 28, 1983

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*CURRENT MARKET DATA*

## CONVERSION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

| Country (currency) | per lb. U as $UF_6$ | per kg U as $UF_6$ |
|---|---|---|
| Australia (dollar) | 1.46 | 3.21 |
| Belgium (comm. franc) | 66.35 | 146.28 |
| Canada (dollar) | 1.72 | 3.79 |
| Finland (markka) | 7.53 | 16.59 |
| France (franc) | 9.58 | 21.13 |
| FRG (Deutschmark) | 3.37 | 7.44 |
| Italy (lira) | 1,944 | 4,287 |
| Japan (yen) | 328.64 | 724.52 |
| Netherlands (guilder) | 3.73 | 8.23 |
| South Africa (rand) | 1.51 | 3.33 |
| Spain (peseta) | 181.82 | 400.84 |
| Sweden (krona) | 10.38 | 22.88 |
| Switzerland (franc) | 2.84 | 6.26 |
| UK (pound) | 0.92 | 2.02 |
| US (dollar) | 1.40 | 3.09 |

## SWU VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

| Country (currency) | FY 1983 per SWU | FY 1984 per SWU |
|---|---|---|
| Australia (dollar) | 107.17 | 114.45 |
| Belgium (comm. franc) | 4,882 | 5,213 |
| Canada (dollar) | 126.46 | 135.05 |
| Finland (markka) | 553.76 | 591.40 |
| France (franc) | 705.00 | 752.91 |
| FRG (Deutschmark) | 248.19 | 265.06 |
| Italy (lira) | 43,056 | 52,778 |
| Japan (yen) | 24,178 | 25,822 |
| Netherlands (guilder) | 274.52 | 293.18 |
| South Africa (rand) | 111.03 | 118.57 |
| Spain (peseta) | 13,377 | 14,286 |
| Sweden (krona) | 763.53 | 815.42 |
| Switzerland (franc) | 208.80 | 222.99 |
| UK (pound) | 67.36 | 71.94 |
| US (dollar) | 103.00 | 110.00 |

[1] Calculated using currency exchange rates published in the Wall Street Journal on February 28, 1983.

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## TRANSACTION SUMMARY[1]

**Uranium Transactions**

| Nuexco Reference Number | Delivery Period | Approximate Quantity (thousands of pounds, $U_3O_8$ equivalent) | Approximate Price as Percent of Current E.V. | Seller | Buyer | Remarks |
|---|---|---|---|---|---|---|
| 2148 | 1983 | 301-600 | unknown | European Utility | European Entity | Enriched $UF_6$ |
| 2151 | unknown | 101-300 | 94 | Canadian Producer | unknown | |
| 2154 | 1983 | Less than 50 | 100 | US Producer | US Producer | |
| 2164 | 1983 | 301-600 | 93 | European Entity | European Utility | $UF_6$ |
| 2189 | 1983 | 101-300 | 100 | US Producer | US Utility | |

**Conversion Transactions**

| Nuexco Reference Number | Delivery Period | Approximate Quantity (thousands of pounds, U equivalent) | Approximate Price as Percent of Current C.V. | Seller | Buyer | Remarks |
|---|---|---|---|---|---|---|

There are no conversion transactions reported this month

**Loan Transactions**

| Nuexco Reference Number | Delivery Period | Approximate Quantity (thousands of pounds, $U_3O_8$ equivalent) | Approximate Price as Percent of Current L.U.C.R. | Lender | Borrower | Remarks |
|---|---|---|---|---|---|---|

There are no loan transactions reported this month.

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[1] Transactions listed are not limited to those in which Nuexco was involved, but also include others of which Nuexco is aware.

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*CURRENT MARKET DATA*

## URANIUM SUPPLY
## (As of 2/28/83)

| Nuexco Reference Number | Delivery Period[1] (Thousands of Pounds $U_3O_8$) Within 1 Year | Beyond 1 Year | Remarks |
|---|---|---|---|
| **Available for Sale:** | | | |
| **ACTIVE** | | | |
| 1575 | | 500 per year | Long Term |
| 1610 | 25 | | |
| 1818 | | 300 per year | Long Term |
| 1921 | 2,100 | | $UF_6$ |
| 2017 | | 2,300 | |
| 2038 | 2,000 | | $UF_6$ |
| 2056 | 2,200 | | $UF_6$ |
| 2126 | 500 | | $UF_6$ |
| 2158 | 500 | | |
| 2203 | 1,200 | | |
| 2216 | 100 | | |
| TOTAL: | 8,625 | | |
| **INACTIVE** | | | |
| 1581 | | 100 per year | Long Term |
| 1805 | | 500 per year | Long Term |
| 1877 | 100 | | |
| 1928 | 1,000 | | $UF_6$ |
| 2134 | | 300 per year | Long Term |
| 2196 | 500 | | |
| TOTAL: | 1,600 | | |

[1] Measured from the date of this Report

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## URANIUM DEMAND
## (As of 2/28/83)

| Nuexco Reference Number | Delivery Period[1] (Thousands of Pounds $U_3O_8$) Within 1 Year | Beyond 1 Year | Remarks |
|---|---|---|---|
| **Inquiries to Purchase:** | | | |
| **ACTIVE** | | | |
| 1652 | | 400 per year | Long Term |
| 1871 | | 250 per year | 1983-86 |
| 1995 | 250 | | |
| 1996 | | 400 | |
| 2010 | | 400 per year | 1984-92 |
| 2030 | | 1,000 | 1984-85 |
| 2042 | | 400 per year | Long Term |
| 2061 | 25 | | |
| 2105 | 600 | | $UF_6$ |
| 2123 | 500 | 500 per year | 1983-87 |
| 2130 | 20 | | $UF_6$ |
| 2149 | 50 | | |
| 2152 | | 750 per year | Long Term |
| 2159 | 1,100 | | |
| 2167 | 250 | 250+ per year | 1984-99 |
| TOTAL: | 2,795 | | |
| **INACTIVE** | | | |
| 1459 | | 200 per year | Long Term |
| 1843 | 250 | | |
| 1888 | | 400 per year | Long Term |
| 1999 | | 50 per year | 1985-90 |
| 2025 | | 350 | |
| 2032 | | 200 | |
| 2114 | 200 | 200 per year | 1984-90 |
| 2115 | 200 | 200 | |
| TOTAL: | 650 | | |

[1] Measured from the date of this Report.

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*CURRENT MARKET DATA*

## CONVERSION SUPPLY
## (As of 2/28/83)

| Nuexco Reference Number | Delivery Period[1] (Thousands of Pounds U as $UF_6$) | | Remarks |
|---|---|---|---|
| | Within 1 Year | Beyond 1 Year | |
| **ACTIVE** | | | |
| 1609 | 500 | 1,500 per year | Long Term |
| 1840 | 130 | | |
| 1936 | 1,000 | 200 per year | Long Term |
| 2051 | 1,000 | | |
| 2143 | | 400 | |
| TOTAL: | 2,630 | | |
| **INACTIVE** | | | |
| 2008 | 800 | 800 | |
| 2181 | 650 | 650 per year | Long Term |
| TOTAL: | 1,450 | | |

## CONVERSION DEMAND
## (As of 2/28/83)

| Nuexco Reference Number | Delivery Period[1] (Thousands of Pounds U as $UF_6$) | | Remarks |
|---|---|---|---|
| | Within 1 Year | Beyond 1 Year | |
| **ACTIVE** | | | |
| 1995 | 220 | | |
| 2129 | 500 | 500 | |
| 2140 | 200 | | |
| 2148 | | 400 per year | 1984-90 |
| TOTAL: | 920 | | |
| **INACTIVE** | None | | |

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[1] Measured from the date of this Report.

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## LOAN SUPPLY AND DEMAND
(As of 2/28/83)

| Nuexco Reference Number | Delivery Period[1] (Thousands of Pounds $U_3O_8$) Within 1 Year | Beyond 1 Year | Remarks |
|---|---|---|---|
| **Available for Loan:** | | | |
| **ACTIVE** | | | |
| 1938 | 1,500 | | |
| 2006A | 600 | | |
| 2121 | 600 | | |
| 2204 | 500 | 200 per year | Long Term |
| TOTAL: | 3,200 | | |
| **INACTIVE** | | | |
| 1815 | 1,000 | | $UF_6$ |
| 1884 | 600 | | |
| 1910 | 1,000 | | |
| 1931 | 600 | | |
| 2036 | 500 | | $UF_6$ |
| 2040 | 600 | | $UF_6$ |
| 2133 | 200 | | |
| 2139 | 2,000 | | |
| 2157 | 600 | | |
| TOTAL: | 7,100 | | |
| **Inquiries to Borrow:** | | | |
| **ACTIVE** | | | |
| 1998 | 200 | 200 | |
| 2006 | 600 | | |
| 2070 | 200 | | $UF_6$ |
| TOTAL: | 1,000 | | |
| **INACTIVE** | None | | |

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[1] Measured from the date of this Report

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## *RECENT DEVELOPMENTS*

### AFRICA

As of February 6, the **South African** authorities removed all exchange controls for non-residents and abolished the dual exchange rate for the rand which had existed since 1961. Non-residents are now permitted to transfer funds into and out of the country freely at a single exchange rate. Previously, all such funds had to be transferred by way of the financial rand, the effective investment currency for non-residents. Traditionally, the financial rand had been discounted against the commercial rand, reflecting the degree of risk foreign investors perceived as inherent in investments in South Africa.

The initial reaction on regional financial markets was mild. The value of the rand on Monday, February 7, fell to 87-88 US cents and domestic interest rates rose slightly. As it became evident that there had been no flight of funds on a major scale, the rand rebounded to 93 US cents (as of February 28) and interest rates returned to prior levels.

The most important effect of the move will be an improvement in South African mines' revenues (in rand terms) from gold sales. This will also apply to any uranium contracts priced in US dollars. The lack of a mass withdrawal of foreign investment currency would appear to confirm the government's belief that the strength of gold, the improvement in South Africa's balance of payments, and recent political moves towards a new constitution to include non-white races, have substantially improved South Africa's standing in the eyes of the international investing community.

### AUSTRALIA

Energy Resources of Australia Limited (ERA) reported a net profit of A$ 24 million for the six months ending December 31, 1982. This profit was earned on revenues of A$ 126 million. Uranium production amounted to 3.7 million pounds $U_3O_8$, slightly more than rated capacity.

* * *

Pancontinental Mining Limited, operator of the Jabiluka joint venture (65 percent Pancontinental, 35 percent Getty Oil Development) is inviting submissions from engineering management groups to offer their services for the project. The company expects to require these services later this year.

Respondents to the invitation will probably include Bechtel, Fluor and Dravo. In addition, Pancontinental is inviting tenders for access road and bridge construction in the Northern Territory from the Arnhem highway to the boundary of the project area. Although the company appears to have recently come to an understanding with the Central Electricity Generating Board (CEGB) of the United Kingdom for the delivery over 10 years of 4.3 million pounds of $U_3O_8$ (including options) starting in 1988, it seems unlikely that the joint venture partners will commit the funds necessary to construct the total project unless much stronger market support is forthcoming.

* * *

The South Australian Labor Party (ALP) Government has offered a decision on the Honeymoon uranium project. This stance leaves South Australia's state government uncommitted until after the federal elections on March 5, 1983. Mr. Hawke, the new ALP leader, has been quoted as saying that, should the Labor party gain office in Canberra, the controversial uranium policy adopted last August (and discussed in some detail in Nuexco Report 168) will "be given effect for concrete proposals." That probably means that the ALP would allow existing mines to continue operating, but would prohibit any new developments.

Recent elections in Western Australia have shown considerable voter preference for Labor which gained 53 percent of the primary vote, unseating the Liberal party after nine years in office. State elections, however, seldom signal voter preferences for the federal parliament correctly.

* * *

The Yeelirrie uranium project (Western Mining Corporation) is likely to experience delays as the new state government comes to terms with the policy issues involved. Potential foreign partners or buyers will most likely adopt a wait-and-see position before entering into serious commitments with this potential supplier.

* * *

The Australian Labor Party (ALP) under its new leader Robert (Bob) Hawke won a decisive victory in the federal elections on March 5. When the counting began on polling day it became obvious from the start that the Fraser government was in trouble. The electorate favored the ALP in all of the mainland states. The ALP took 20 seats from the liberals and 2 seats from the National Party, its coalition partner.

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Mr. Hawke will govern with a majority of 25 or 27 seats in the House of Representatives (Lower House). However, the electorate did not give the ALP a full mandate in the Senate (Upper House). Labor gained only 30 of the 64 seats, with the Australian Democrats again holding the balance of power. This should hold no fears for the ALP as the Democrats have sided with Labor on many issues. The necessity for the government to consider the attitudes of a third party when framing its legislation is not unusual in Australian politics. The former coalition government also had to work without a Senate majority. For Mr. Fraser, this was a rather frustrating experience. At the time when he called the election, which was officially due much later in the year, 13 pieces of legislation had been defeated in the Senate.

Mr. Fraser has resigned from the leadership of the Liberal Party. Having seen its leadership repudiated, the Liberal Party faces a huge rebuilding task. The party suffered severe setbacks in Queensland and Western Australia. Elsewhere it has been reduced to a handful of metropolitan seats. Therefore, it would not be surprising for the ALP to govern Australia for more than one three-year term.

During the campaign, it became clear that this election dealt with issues deeper than theories of economic management. What caused the demise of the Fraser government? Mr. Hawke offered consensus, Mr. Fraser countered with confrontation. Mr. Hawke offered hope, Mr. Fraser countered by selling fear.

Mr. Hawke and his team presented a credible picture to the Australian people. Whether the ALP as a party can curb its militant left wing and fulfill the expectations of the electorate must remain an open question, but the majority of Australians are prepared to give them the opportunity.

## EUROPE

In **Portugal**, Sr. Ricardo Bayao Horta, the Minister for Industry and Energy, has presented a national energy plan calling for Portugal to choose a nuclear energy program by mid-1984. If no decision has been made by that time to build four 1000 MWe nuclear reactors, the country will have to rely more heavily on coal, even though Portugal's 8000 metric tons of measured uranium reserves could be used to reduce energy imports in the long run.

Portugal is dependent on outside sources for all of its oil, most of its coal, and 25 percent of its electricity. Severe drought conditions in Portugal, which have led to hydro-electric reserves falling to a very low level, underline the importance of the decisions to be taken.

* * *

In the **United Kingdom**, the design contract for the pressure vessel for Sizewell B has gone to Framatome. More importantly, Framatome will also get the construction contract if Sizewell B is approved.

The UK uranium purchasing authorities have announced their intention not to renew the UK uranium contract with Rio Tinto-Zinc's Rossing mine in Namibia because the country has a huge uranium stockpile. In a written parliamentary reply to a House of Commons question, the Energy Department Under-Secretary, Mr. John Moore, said the Central Electricity Generating Board (CEGB) had "no plans to obtain further uranium from Namibia" after the contract with Rossing expires in 1984. A CEGB spokesman said stocks are more than sufficient to supply the country's uranium needs for several years. Although the exact size of the stockpile is secret, a reasonable estimate would be greater than 20 million pounds $U_3O_8$, an amount sufficient to supply Britain's nuclear power program for six years at current consumption rates.

After a trip to Namibia, Kenneth Marsden, the mining editor of the Financial Times, reported that Rossing was producing at only 93 percent of its design rate of 10.5 million pounds of uraniun oxide a year. That could indicate that Rossing would have difficulty finding other customers for the output that has been going to the UK. In that event, production rates could fall to levels at which the operation would become uneconomic.

On the one hand, the UK is diversifying its sources of supply and has announced a tentative agreement to buy uranium from Pancontinental (Australia). However, the decision to end the Rossing contract shows that the CEGB has more than sufficient uranium, so it will not necessarily need to buy more uranium from Australia or any other suppliers.

In last year's annual report, RTZ said Rossing contributed 63 million pounds sterling, or 18 percent, of its pre-tax profit in 1981. RTZ's net beneficial interest in Rossing is 46.5 percent. General Mining has a 2.3 percent share in Rossing and the Industrial Development Corporation has 13.5 percent. Other shareholders include the French consortium Minatome and Urangesellschaft. Table 2 shows a breakdown of Rossing's ownership.

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## *RECENT DEVELOPMENTS*

### Table 2
### ROSSING'S OWNERSHIP BREAKDOWN

| Rossing Shareholders | Percentage of Ownership |
|---|---|
| RTZ | 41.35 |
| Rio Algom[1] | 10.0 |
| Industrial Development Corp. of South Africa | 13.5 |
| Minatome (France) | 10.0[2] |
| Urangesellschaft (West Germany) | 5.0[2] |
| General Mining Corp. | 2.3 |
| AEOE (Iran) | 15[2] |
| Unknown | 3[2] |

[1] RTZ owns 51.3% of Rio Algom, so RTZ's net beneficial interest in Rossing is 46.5%.

[2] Nuexco estimate

* * *

The results of the **West German** federal election on March 6 are presented in Table 3. The implications of these results are twofold. First, because the Free Democrats will align with the Christian Democrats to control the government, Helmut Kohl should remain Chancellor for the next four years. This is seen as a victory for the conservatives. The German economy should improve as a result, and indirectly this is favorable for nuclear power.

### Table 3
### GERMAN ELECTION RESULTS

| Parties | Vote Percentage | Number of Seats |
|---|---|---|
| Christian Democrats | 48.8 | 244 |
| Free Democrats | 6.9 | 34 |
| Social Democrats | 38.2 | 191 |
| Green Party | 5.6 | 27 |
| | 100 | 496 |

Second, for the first time the Green Party will be represented in Parliament. They achieved this by winning more than 5 percent of the vote. It should be interesting to note how the relatively young members of the Party react to this new responsibility, even though they are not likely to have any effect on government policies.

The control of government by the Christian Democratic Party is expected to be positive for the German economy in general and for the nuclear power industry in particular, since the Christian Democratic Party has called for rapid expansion of the Nuclear Electric Generation in Germany.

## FAR EAST

In Nuexco Report 165 of May 1982, Nuexco observed that **Japan**'s announced plans for 54 nuclear units and 46,619 MWe in operation by March 1991 appeared overly ambitious, and were unlikely to be realized. It was suggested that "a more realistic scenario would be a continuation of the historical trend" that "would result in some 44 or 45 units and some 36,000 to 37,000 MWe in service by March 31, 1991."

Japan's utilities recently announced that a "realistic capacity" by the end of March 1991 would be 45 reactors totaling 37,350 MWe. This downward shift reflects adjustments associated with siting problems, as well as a continuation of lower-than-expected rates of electric growth.

Based on Nuexco's reevaluation of the Japanese situation, it is our opinion that the "quite conservative" scenario mentioned last month in Report 174 is a more realistic estimate for planning purposes. We now forecast a total of 41 nuclear units and approximately 33,500 MWe in operation in Japan by March 1991. The Japanese utilities' plans call for an additional 10 units, not yet under construction, to be completed and operating by that time, but Nuexco believes no more than six will be added by that date. Table 4 compares the two forecasts as of March 1991. Table 5 provides an annual breakdown and comparison of the utilities' plans and the Nuexco forecast. The Apparent Future Consumption associated with Nuexco's forecast is summarized in Table 6.

Japanese recognition of the slower rate of nuclear power growth, in light of existing commitments to purchase uranium, conversion and enrichment, suggests a more cautious procurement approach in the near to intermediate term. It also suggests the possibility of a harder line in contrast renegotiations, as well as the possibility of secondary market operations.

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### Table 4

### NUCLEAR DEVELOPMENT[1] IN JAPAN AS OF MARCH 1991

| | Number of reactors | | Capacity (MWe) | |
|---|---|---|---|---|
| | **Utilities' Plans** | **Nuexco Forecast** | **Utilities' Plans** | **Nuexco Forecast** |
| Operating Reactors | 24 | 24 | 17,177 | 17,177 |
| Under Construction | 11 | 11 | 10,704 | 10,704 |
| Planned: Approved | 7 | 4 | 6,183 | 3,599 |
| Planned: Not Approved | 3 | 2 | 3,290 | 2,090 |
| TOTAL | 45 | 41 | 37,354 | 33,570 |

[1] Excludes Fugen ATR and Monju FBR

### Table 5

| | REACTORS | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Under Construction | | Planned (Authorized) | | Planned (Not Authorized) | | Yearly Total | |
| **Year of Planned Operation** | **Utilities' Plans** | **Nuexco Forecast** | **Utilities' Plans** | **Nuexco Forecast** | **Utilities' Plans** | **Nuexco Forecast** | **Utilities' Plans** | **Nuexco Forecast** |
| 1983 | — | — | — | — | — | — | — | — |
| 1984 | 4 | 3 | — | — | — | — | 4 | 3 |
| 1985 | 3 | 2 | — | — | — | — | 3 | 2 |
| 1986 | 3 | 2 | — | — | — | — | 3 | 2 |
| 1987 | 1 | 2 | — | — | — | — | 1 | 2 |
| 1988 | — | 2 | 2 | — | — | — | 2 | 2 |
| 1989 | — | — | 2 | 3 | 1 | — | 3 | 3 |
| 1990 | — | — | 3 | 1 | 1 | 2 | 4 | 3 |
| 1st quarter 1991 | — | — | — | — | 1 | — | 1 | — |
| Total | 11 | 11 | 7 | 4 | 3 | 2 | 21 | 17 |

### Table 6

| | Millions of Pounds $U_3O_8$ | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Reactors** | **1983** | **1984** | **1985** | **1986** | **1987** | **1988** | **1989** | **1990** | **1991** |
| In Operation (24) | 6.2 | 6.2 | 6.0 | 5.9 | 5.8 | 5.7 | 5.5 | 5.4 | 5.3 |
| Under Construction (11) | 2.5 | 3.2 | 4.4 | 4.7 | 3.5 | 3.5 | 3.4 | 3.4 | 3.3 |
| Planned (Approved) (4) | 0 | 0 | 0 | 0 | 2.8 | 1.6 | 1.7 | 1.1 | 1.4 |
| Planned (Not Approved) (2) | 0 | 0 | 0 | 0 | 0 | 2.3 | 0.4 | 0.6 | 0.6 |
| TOTAL | 8.7 | 9.4 | 10.4 | 10.6 | 12.1 | 13.1 | 11.0 | 10.5 | 10.6 |

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* * *

In **Taiwan**, nuclear power accounted for 30.61 percent (up from 25 percent in 1981) of the 40,899 Gigawatt-hours of electricity generated from nuclear power in 1982. The balance was supplied by oil (48 percent), coal (10 percent) and hydroelectric power (12 percent). Having risen by 1.87 percent, total electricity generation more than offset the 1.32 percent decline experienced in 1981. The availability and capacity factors for Taiwan's operating nuclear units are presented in Table 7.

### Table 7

### TAIWAN REACTORS' PERFORMANCE IN 1982

| Reactor | Availability Factor | Capacity Factor |
|---|---|---|
| Chinshan 1 | 65.15 | 52.45 |
| Chinshan 2 | 85.60 | 80.26 |
| Kuosheng 1 | 64.80 | 51.09 |

## UNITED STATES

US activities in the nuclear fuel market are characterized by continued consolidation of the uranium production sector. This was evidenced by the sale of one mill, and the announcements of three production facility closures (Ogle's Bison Basin; Homestake's Pitch; Minerals Exploration's Sweetwater) in the reporting period.

Out of this environment is emerging a small group of aggressive uranium producers who are expanding their uranium holdings or beginning to act as traders in the market. On the other end of the spectrum are those producers who are making plans for withdrawing from the market via the disposition of properties or the closing of production facilities. The result is a bi-modal distribution of producer activities. Very few are pursuing conventional strategies. The last month has seen the virtual disappearance of the US utilities as sellers. Our readers will recall that a few months ago the sellers were dominated by the utility group.

However, now it appears that the majority of US utilities have stablized their inventories at acceptable levels, at least for the short term. So long as interest rates and $U_3O_8$ prices remain relatively low, most utilities probably will refrain from further selling of inventory. On the other hand, increases in either interest rates or uranium prices could trigger further selling of inventories.

Buyers at this time are focusing on the longer term; the spot and near-term markets (next 12 months) are relatively small. Price competition brought buyers to the spot market in 1982 even though the buyer's needs were longer term. This situation allowed the buyer to purchase in advance of need and hold the material until needed, at an acceptable rate of imputed interest. As the market has risen over the past several months, the price is no longer sufficiently attractive to cause spot or near-term purchasing in advance of need. The result has been a gradual decline in activity in the market for delivery within 12 months. That near-term US demand which does exist has two principal sources:

1. Changing requirements arising from changes in enrichment tails assays;
2. Small quantities sought by producers to satisfy delivery obligations.

* * *

Energy Fuels has sold a majority interest in the Blanding mill to Union Carbide. The operational result will provide the buyer with milling service closer to some of its existing mines. At the same time, the seller, who is concentrating exploration and production in Arizona, may elect to construct milling services closer to its mines and reserves.

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## 1982 URANIUM PRODUCTION

Nuexco's estimate of 1982 production is presented in Table 8, showing 1982 estimated uranium production for the major producing regions in the Free World as compared with actual 1981 production.

**Table 8**

**WORLD URANIUM PRODUCTION**
**(millions of pounds $U_3O_8$)**

| Country | 1981 (Actual) | 1982 (Estimated) | Percent Change |
|---|---|---|---|
| Australia | 8.1 | 11.6 | +43 |
| Canada | 20.0 | 21.0 | +5 |
| France | 6.4 | 7.6 | +19 |
| South Africa | 15.9 | 15.1 | -5 |
| Other Africa | 24.3 | 23.7 | -2 |
| Other | 1.2 | 1.6 | +33 |
| Subtotal | 75.9 | 80.6 | +6 |
| US | 38.7 | 25.3 | -35 |
| TOTAL | 114.6 | 105.9 | -8 |

The 8 percent decline in total worldwide uranium production in 1982 is largely a result of declines in US and African production during the year. During 1982, large inventories were sold on the spot market, resulting in US producers ceasing their higher cost production and becoming buyers, competing for material at spot prices to satisfy their requirements contracts. South African production decreased by 5 percent, primarily due to a uniform production cutback by all of the Chamber of Mines producers. This cutback was caused by the completion of prior contracts and the inability to acquire new ones. Niger and Gabon had substantial cutbacks in production due to the inability on the part of both governments to sell the approximate one-third share that they assume of all material produced.

As Table 8 indicates, increases in production from Australia and France partially offset the decline in US production. Australia's 43 percent increase is a result of ERA's Ranger mine reaching its design operating capacity. The increase in French production is directly attributable to the French desire to build their own inventories. Two facilities, Dong Trieu's Mailhac operation, and SIMO's (Societe Industrielle des Minerais de l'ouest) Lodeve facility reached full production capacities in 1982.

Table 9 presents a comparison of preliminary 1982 estimates with actual US uranium production figures for that year. Actual production from unconventional mining and milling operations fell short of the forecast level by 1.7 million pounds $U_3O_8$. The substantial decrease shows that by-product and in situ uranium producers are not as well insulated from uncertainties in the industry as we had thought. The total of all operating production centers in the US produced 9.6 percent less than predicted a year ago, a divergence resulting from US producers being more responsive than expected to inventory selling on the spot market.

**Table 9**

**1982 US PRODUCTION**
**(millions of pounds $U_3O_8$)**

| | 1982[1] (Forecast) | 1982 (Estimated) | Percent Change |
|---|---|---|---|
| Operating Unconventional | 7.5 | 5.8 | -23 |
| Operating Conventional | 20.5 | 19.5 | -5 |
| TOTAL | 28.0 | 25.3 | -10 |

[1] Nuexco's "Uranium World Market Study and Price Forecast: 1982-1996," March 1982

The regional distribution of US production is shown in Table 10. Those states most affected by the substantial overall decline in US production in 1982 were New Mexico, Wyoming, and Texas. Table 11 presents an alternate perspective on the internal distribution of US production. Those readers desiring further detail may refer to Nuexco Report 173 (January 1983), which contained an extensive summary of the activities of US uranium producers in 1982.

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*ANALYSIS & COMMENTARY*

### Table 10

### US URANIUM PRODUCTION BY STATE

**(millions of pounds $U_3O_8$)**

| Mill Location | 1981 (Actual) | 1982 (Estimate) | Percent Change |
|---|---|---|---|
| New Mexico | 12.3 | 7.6 | -38 |
| Texas | 6.3 | 4.1 | -35 |
| Wyoming | 8.2 | 4.8 | -41 |
| Utah | 6.1 | 4.2 | -31 |
| Others | 5.8 | 4.6 | -21 |
| TOTAL | 38.7 | 25.3 | -35 |

### Table 11

### INDIVIDUAL STATES AS PERCENTAGES OF TOTAL US PRODUCTION

| State | Percent of Total 1981 Production | Percent of Total 1982 Production |
|---|---|---|
| New Mexico | 32 | 30 |
| Texas | 16 | 16 |
| Wyoming | 21 | 19 |
| Utah | 15 | 17 |
| Others | 16 | 18 |

Nuexco's forecast for 1983 anticipates the continuation of the decline in worldwide uranium production. As indicated in Table 12, the forecast calls for a 9 percent decrease in which substantial cutbacks in the US, Central Africa and Namibia more than offset modest increases in other regions.

### Table 12

### WORLD URANIUM PRODUCTION

**(millions of pounds $U_3O_8$)**

| Country | 1982 (Estimated) | 1983 (Forecast) |
|---|---|---|
| Australia | 11.6 | 11.3 |
| Canada | 21.0 | 21.8 |
| France | 7.6 | 8.0 |
| South Africa | 15.1 | 16.4 |
| Other Africa | 23.7 | 20.8 |
| Other | 1.6 | 2.5 |
| Subtotal | 80.6 | 80.8 |
| US | 25.3 | 15.4 |
| TOTAL | 105.9 | 96.2 |

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## CROW BUTTE URANIUM DEPOSIT

### Introduction

The Crow Butte uranium deposit is located in northwest Nebraska near the town of Crawford (Figure 1). The deposit was discovered during the fall of 1980 by the Wyoming Fuel Company, operator of the Crow Butte Joint Venture. The Crow Butte Joint Venture is owned 50 percent by Wyoming Fuel Company, a subsidiary of Kansas-Nebraska Natural Gas Company, Inc., 40 percent by Ferret Exploration Company, Inc. and 10 percent by First Exploration Company, Inc. A preliminary announcement made in January 1981 indicated a "probable potential" reserve in excess of 25,000,000 pounds $U_3O_8$. Drilling during 1981 and 1982 confirmed these reserves and indicated the presence of more than 30,000,000 pounds $U_3O_8$ having an average grade in excess of 0.25 percent $U_3O_8$.

Wyoming Fuel Company was initially attracted to the area in 1978 by favorable regional geology for sandstone uranium deposits and weak radioactivity noted in regional oil and gas holes. Exploration drilling began in 1979 following the formation of the Crow Butte Joint Venture. Drilling has continued up to the present, at which time the Joint Venture is ready to proceed with a pilot scale solution mine. Environmental baseline data have been acquired and the permit applications for the pilot scale mine have been submitted to the Nuclear Regulatory Commission and to the applicable state agencies in Nebraska.

### Geographic Setting

The Crow Butte deposit is in the Pine Ridge country of northwest Nebraska. The main portion of the deposit lies north of the Pine Ridge escarpment on gradual sloping terrain with local relief of less than 100 feet. The Pine Ridge escarpment surrounds the main deposit on three sides and is about 500 feet higher in elevation than the northward sloping plain. The Pine Ridge is covered with ponderosa pine and is formed by a major sandstone unit.

The climate, typical of a semi-arid continental climate, is characterized by warm summers, cold winters, light precipitation and frequent changes in the weather. The average precipitation is 15.5 inches distributed mostly during the spring and summer. Average temperature ranges from 23 degrees F in January to 74 degrees F in July, with extremes ranging from -29 degrees F to 110 degrees F.

The land in the area of the deposit is largely privately owned and used for agriculture with a population density of about 12 persons per square mile. Winter wheat and hay are the principal crops and cattle are the principal livestock.

Nearby Crawford is a town of 1315 people whose economy is based on agriculture and tourism. Fort Robinson State Park is located immediately west of the town; other nearby points of interest are the Nebraska National Forest to the southeast and the Black Hills 90 miles to the north. Chadron, with a population of 5933, the largest community in the immediate area, is 25 miles to the east. Scottsbluff, located 75 miles to the south, is the largest community and the principal trade center for northwest Nebraska and eastern Wyoming.

### History of Discovery

Wyoming Fuel Company acquired a regional lease position of about 64,000 acres along the Chadron Formation outcrop (Figure 2) of northwest Nebraska in the spring of 1978. The lease position extended from north of Harrison to southeast of Crawford, a distance of about 30 miles.

The lease position was acquired to explore for sandstone uranium mineralization in an area that had received little exploration previously. The position was acquired based on regional oil and gas exploration data. Widely spaced oil and gas exploration holes, 0 to 5 holes per township, indicated an extensive fluvial sandstone system at the base of the Tertiary overlying the Cretaceous Pierre Shale. This fluvial sandstone is the basal sandstone unit of the Chadron Formation of Oligocene age. In the Crawford area it was noted that five oil and gas holes had gamma spikes in the sandstone indicating approximately .005 to .025 percent $eU_3O_8$. (In this context, $eU_3O_8$ refers to estimation by means of radiometric measurement.) In addition, methane gas shows had been reported from several oil and gas holes and water wells in the Crawford area. There was also some evidence of oxidation-reduction interfaces based on a lithologic log of one of the oil and gas holes.

Wyoming Fuel Company and Ferret Exploration Company formed a joint venture during the late summer of 1979. Wyoming Fuel Company, designated as project operator, undertook a regional exploration drilling program. Property evaluation began during 1979 and 95 exploration drill holes totaling approximately 50,000 feet were completed. The holes were widely spaced on one or two mile centers. In areas of encouragement, a

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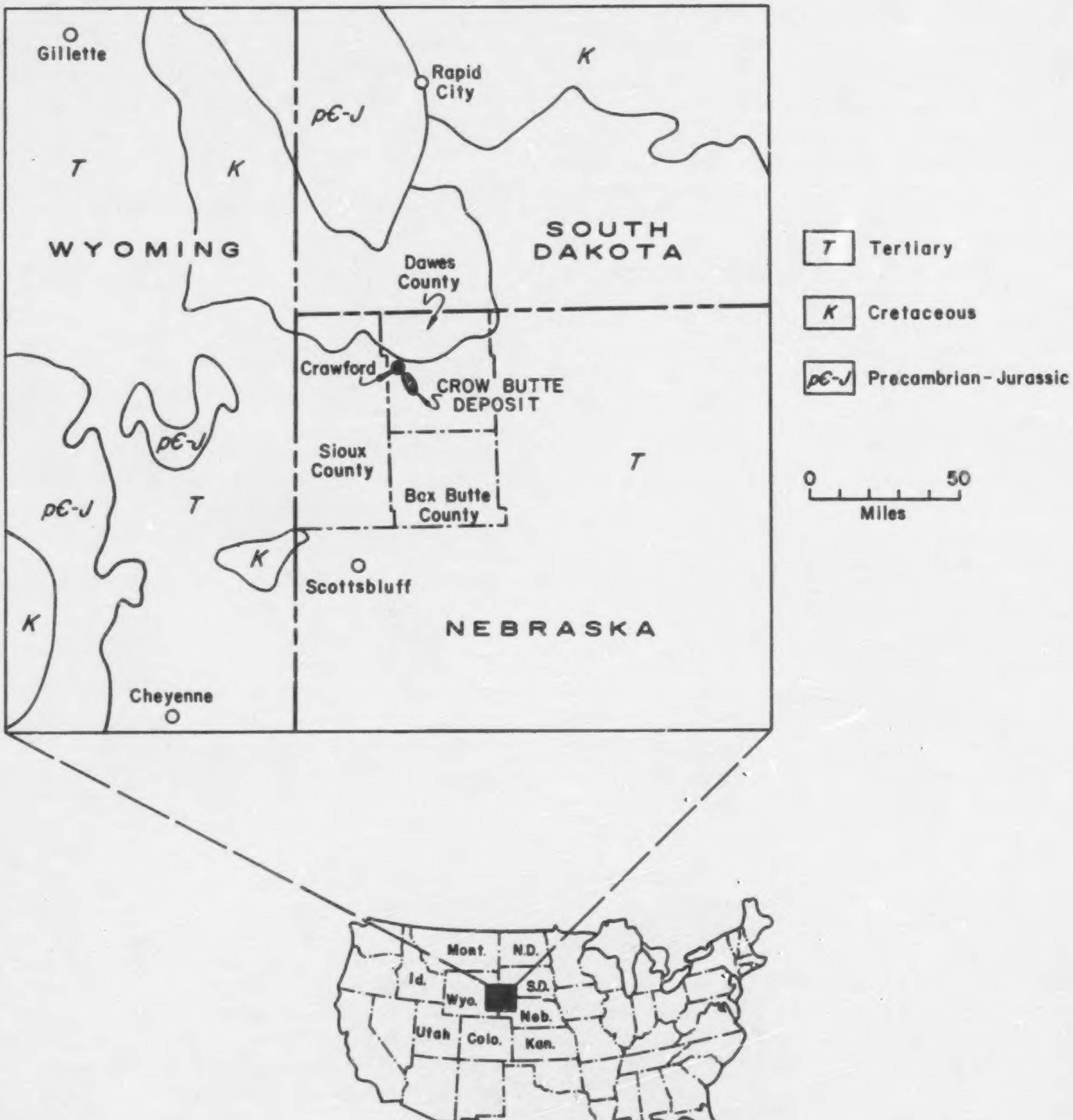
Gillette
Rapid City
K
pЄ-J
T
K
WYOMING
SOUTH DAKOTA
Dawes County
Crawford
CROW BUTTE DEPOSIT
pЄ-J
Sioux County
T
pЄ-J
T
Box Butte County
K
Scottsbluff
K
NEBRASKA
Cheyenne
T Tertiary
K Cretaceous
pЄ-J Precambrian-Jurassic
0
50
Miles
Mont.
N.D.
Id.
S.D.
Wyo.
Neb.
Utah
Colo.
Kan.

Figure 1

CROW BUTTE URANIUM DEPOSIT
Location and Regional Geology

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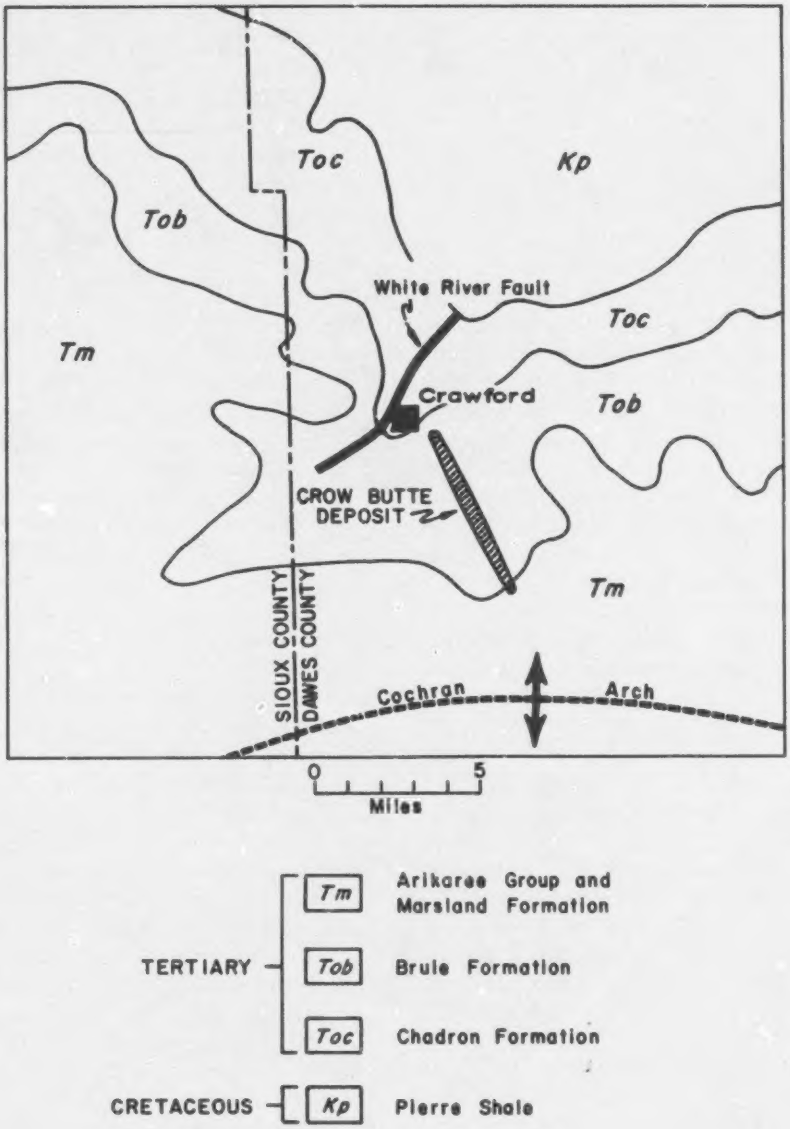
Toc
Kp
Tob
Tm
White River Fault
Toc
Crawford
Tob
CROW BUTTE DEPOSIT
Tm
SIOUX COUNTY
DAWES COUNTY
Cochran Arch
0
5
Miles
TERTIARY
Tm Arikaree Group and Marsland Formation
Tob Brule Formation
Toc Chadron Formation
CRETACEOUS
Kp Pierre Shale

Figure 2

CROW BUTTE URANIUM DEPOSIT — NORTHWEST NEBRASKA
Local Geology

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few holes were drilled on a one-fourth to one-half mile spacing. Two areas of encouragement were encountered during this drilling. An area north of Crawford was identified as having considerable weak uranium mineralization associated with vague oxidation-reduction boundaries adjacent to the White River fault. This was in the same general area of weakly radioactive oil and gas holes and methane gas shows.

Following the 1979 drilling, the lease position was consolidated and additional acreage was leased in the area of encouragement. A more extensive drill program was planned for the next phase of project evaluation.

During 1980, reconnaissance drilling continued within the lease block and follow-up drilling continued in areas with encouraging results. The 100th hole of the 1980 drill program intersected the first ore grade mineralization (0.1% $eU_3O_8$). After an additional 65 holes, a mineralized trend based on three additional holes was indicated to extend about six miles southeast of Crawford.

Following additional lease acquisition, the operator increased the pace of close-spaced drilling. An additional 148 holes were drilled during 1980 to define the mineralized trend which was named Crow Butte (Figure 2) for a prominent butte of the Pine Ridge southeast of Crawford. A total of 408 drill holes had been drilled to date.

At this point, the Crow Butte mineralized trend was determined to be about six miles long and up to 3000 feet wide as defined by a drill hole spacing pattern of 400 feet by 1000 feet in the shallower northern part and 400 feet by 2500 feet along the deeper southern part. Depths to mineralization varied from 275 to 820 feet. Based on 127 holes drilled within the Crow Butte mineralized trend, a news release of January 12, 1981 stated that "probable potential" reserves at the Crow Butte prospect exceeded 25 million pounds $U_3O_8$.

An additional 850 holes drilled during 1981 further defined the grade, thickness and extent of the Crow Butte mineralized trend. The trend was drilled out on a 200 foot by 200 foot grid. Ore reserves of the Crow Butte Deposit (Figure 2) calculated following the 1981 drilling indicated over 30 million pounds $U_3O_8$ in place with an average grade in excess of 0.25% $eU_3O_8$. In addition, chemical analyses of a large number of samples from core holes throughout the deposit indicated that the ratio of chemical uranium to equivalent uranium exceeds 1.20.

Reconnaissance drilling during 1982 doubled the known length of the Crow Butte trend; however, drill hole spacing is too wide to calculate additional reserves. Detailed drilling on a 50 to 100 foot spacing confirmed that the 200 foot grid was adequate for reserve calculations and defined an area for a pilot solution mining operation. Baseline environmental data were also gathered during 1982 for a research and development permit to operate the pilot solution mine. The permit application was submitted during February of 1983.

**Geology**

Sedimentary strata ranging from Late Cretaceous through Tertiary are exposed throughout the project area (Figure 2). The Pierre Shale of Late Cretaceous age is the oldest formation exposed in the project area. The Pierre Shale is 1200 to 1500 feet thick and outcrops north of Crawford, forming an impermeable zone below the mineralized unit.

Overlying the Pierre Shale is the White River Group of Oligocene age and consists of the Chadron and Brule Formations (Figure 3). The Chadron Formation is the oldest Tertiary formation on record in northwest Nebraska. Comprised of three distinct members, it lies with marked unconformity on the Pierre Shale. The host member of the Crow Butte uranium deposit is the Basal Sandstone, the depositional product of a large vigorous braided stream system. Regionally, the Basal Sandstone thickness ranges from 0 to 350 feet and has an average thickness of 40 to 60 feet in the area of the deposit.

The Middle Chadron Member represents a distinct facies change from the underlying Basal Sandstone. The Middle Chadron is characterized by green and red interbedded clays. The Middle Chadron has a thickness ranging from 40 to 100 feet. The Upper Chadron consists of massive claystones and siltstones ranging in color from a dark blue-green to greenish brown. The Upper Chadron averages 100 feet thick.

The Brule Formation lies conformably on top of the Chadron Formation. It has been subdivided into two separate members, the Orella and Whitney. The Orella is composed of buff to brown siltstones with persistent spotty green nodules as it grades into the green clays of the Chadron. The Whitney Member of the Brule is comprised of fairly massive buff to brown siltstones in part, Eolian in origin. The Brule Formation ranges from 500 to 650 feet in thickness.

The Middle and Upper Chadron Members and Brule Formation form the impermeable zone above the mineralized unit. The upper impermeable zone ranges from 200 to 600 feet in thickness.

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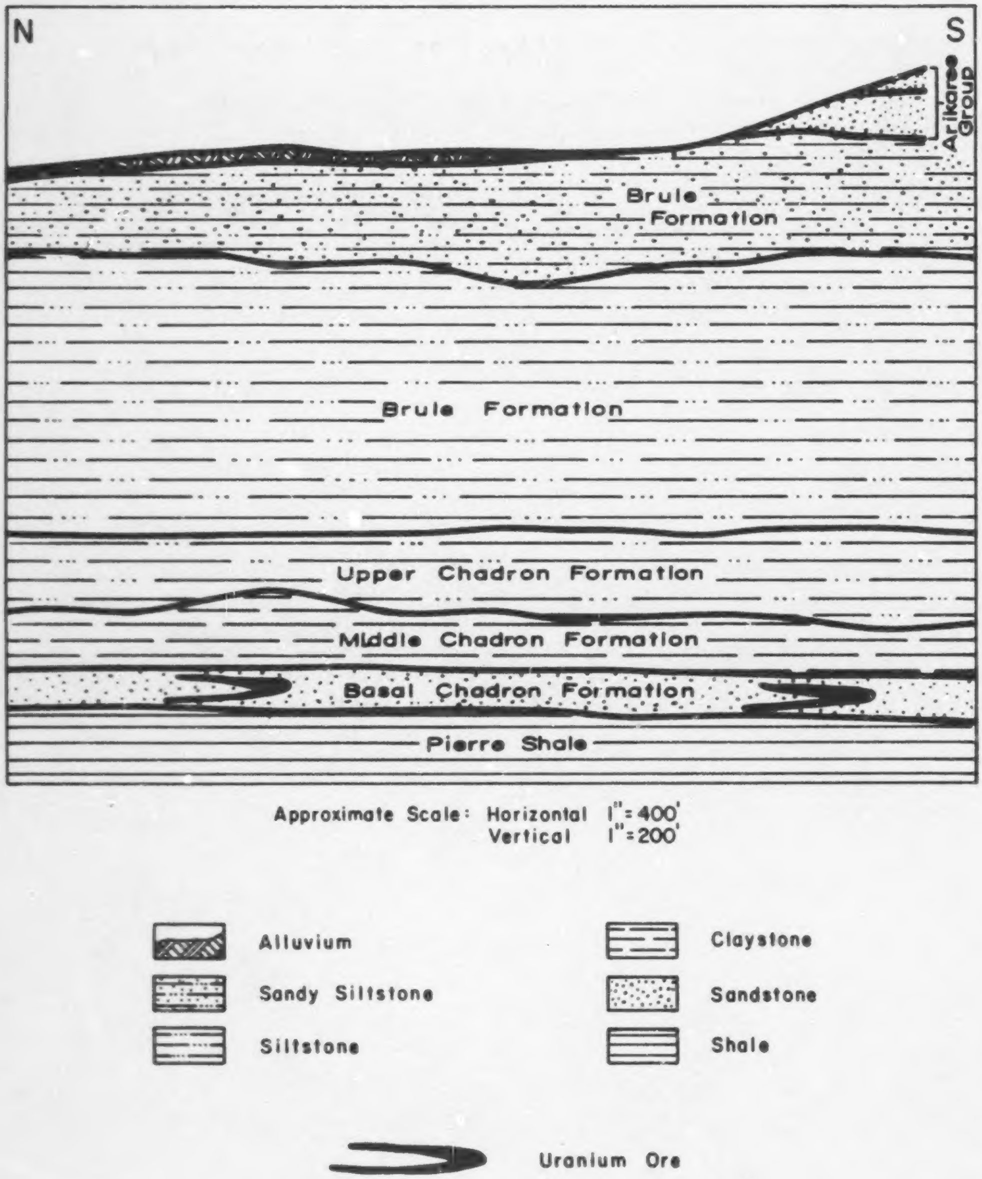
N
S
Arikaree Group
Brule Formation
Brule Formation
Upper Chadron Formation
Middle Chadron Formation
Basal Chadron Formation
Pierre Shale
Approximate Scale: Horizontal 1"=400'
Vertical 1"=200'
Alluvium
Sandy Siltstone
Siltstone
Claystone
Sandstone
Shale
Uranium Ore

**Figure 3**

**CROW BUTTE URANIUM DEPOSIT — NORTHWEST NEBRASKA**
**Generalized Cross Section**

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Overlying the White River Group is the Arikaree Group which includes three Miocene Sandstone Formations: the Gering Formation; the Monroe Creek Formation; and the Harrison Formation. The Arikaree Group forms the Pine Ridge which is present south and east of the Crow Butte Deposit.

**Structure**

The Crow Butte ore deposit lies in what has been named the Crawford Basin. The Crawford Basin lies south of the Black Hills, west of the Chadron Arch, and north of the Cochran Arch. The synclinal axis of the Crawford Basin trends roughly east-west and plunges west into what is informally referred to as the Inner Crawford Basin. The Inner Basin is characterized by the rather sharp paleotopographic change in the Pierre Shale with dramatic increases in the thickness of the Basal Chadron Sandstone. The White River Fault is located directly north of Crawford and strikes northeast and southwest with the upthrown side on the south. The total vertical displacement is 300-400 feet. The displacements of the Chadron and Brule Formations date the fault as post-Oligocene.

**Mineralization**

The Basal Chadron Sandstone, host for the Crow Butte uranium deposit, is a coarse grained sandstone with frequent interbedded thin clays. The Basal Chadron is an arkosic sandstone with approximately 50 percent monocrystalline quartz, 30-40 percent undifferentiated feldspar, plagioclase feldspar and microcline feldspar. The remainder includes polycrystalline quartz, chert, chalcedonic quartz, various heavy minerals and pyrite. The only uranium mineral identified to date is coffinite, a uranium silicate.

**Future Activity**

Preliminary engineering and metallurgical studies indicate the Crow Butte uranium deposit is amenable to solution mining techniques. The joint venture has tentative plans to construct and operate a pilot scale solution mine in late 1983 or early 1984 to demonstrate the technical feasibility of in situ mining and restoration of the deposit. The pilot mine will require about one year of operating time, after which the joint venture will determine the next phase in project development.

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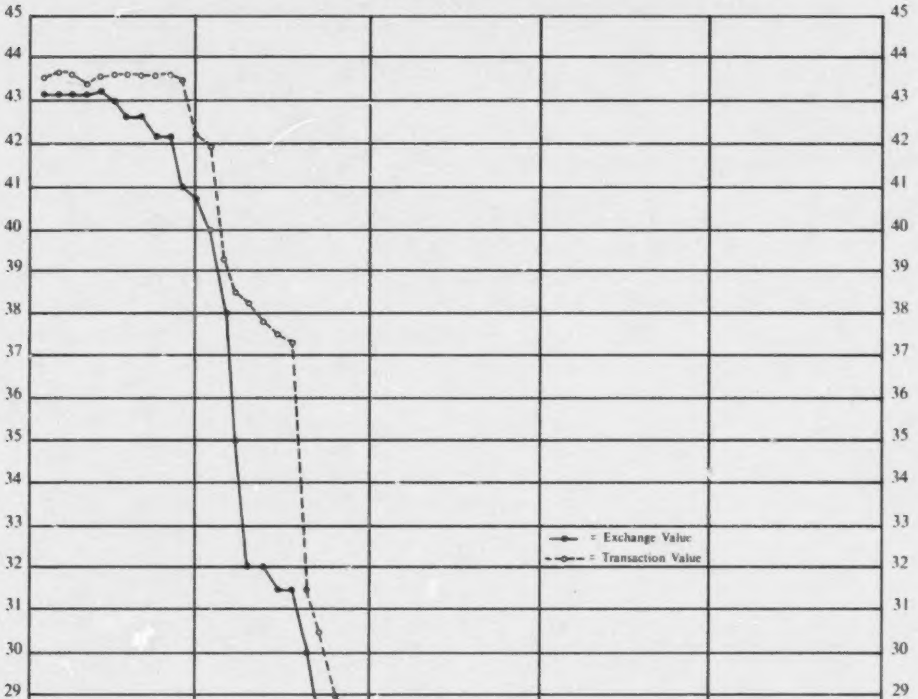
*HISTORICAL MARKET DATA*

## EXCHANGE AND TRANSACTION VALUES SINCE JANUARY 1979

Determined as of the last day of the month indicated



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*HISTORICAL MARKET DATA*

## HISTORICAL EXCHANGE VALUES

Determined as of the last day of the month indicated (US Dollars/lb. $U_3O_8$)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1968 | — | — | — | — | — | — | — | 6.35 | 6.35 | 6.40 | 6.45 | 6.50 |
| 1969 | — | 6.35 | 6.10 | 6.10 | 6.25 | 6.25 | 6.20 | 6.20 | 6.15 | 6.15 | 6.15 | 6.20 |
| 1970 | 6.30 | 6.30 | 6.30 | 6.30 | 6.30 | 6.30 | 6.30 | 6.20 | 6.15 | 6.15 | 6.15 | 6.15 |
| 1971 | 6.20 | 6.20 | 6.20 | 6.20 | 6.15 | 6.05 | 6.00 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 |
| 1972 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 |
| 1973 | 5.95 | 6.00 | 6.10 | 6.20 | 6.45 | 6.50 | 6.50 | 6.50 | 6.50 | 6.50 | 6.75 | 7.00 |
| 1974 | 7.70 | 7.90 | 8.00 | 9.00 | 9.50 | 10.50 | 11.50 | 12.00 | 12.50 | 14.00 | 14.75 | 15.00 |
| 1975 | 16.00 | 16.00 | 18.00 | 20.00 | 21.00 | 23.00 | 24.70 | 26.00 | 26.00 | 28.50 | 30.00 | 35.00 |
| 1976 | 35.20 | 37.00 | 39.25 | 40.00 | 40.00 | 40.00 | 40.00 | 40.40 | 41.00 | 41.00 | 41.50 | 41.00 |
| 1977 | 41.35 | 41.50 | 41.60 | 41.60 | 42.00 | 42.25 | 42.25 | 42.25 | 42.40 | 42.75 | 43.20 | 43.20 |
| 1978 | 42.90 | 43.25 | 43.25 | 43.25 | 43.40 | 43.40 | 43.40 | 43.10 | 43.25 | 43.00 | 43.25 | 43.25 |
| 1979 | 43.25 | 43.25 | 43.25 | 43.25 | 43.25 | 43.00 | 42.70 | 42.70 | 42.20 | 42.20 | 41.00 | 40.75 |
| 1980 | 40.00 | 38.00 | 35.00 | 32.00 | 32.00 | 31.50 | 31.50 | 30.00 | 28.50 | 28.00 | 28.00 | 27.00 |
| 1981 | 25.00 | 25.00 | 25.00 | 25.00 | 25.00 | 24.25 | 23.50 | 23.50 | 23.50 | 23.50 | 23.50 | 23.50 |
| 1982 | 23.00 | 23.00 | 22.50 | 20.75 | 20.50 | 19.25 | 18.25 | 17.00 | 17.00 | 17.50 | 19.75 | 20.25 |
| 1983 | 21.50 | **21.75** | | | | | | | | | | |

## HISTORICAL TRANSACTION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. $U_3O_8$)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1976 | — | — | — | — | 39.60 | 39.70 | 39.70 | 40.40 | 40.30 | 40.60 | 40.70 | 40.70 |
| 1977 | 41.30 | 41.30 | 41.40 | 41.50 | 42.80 | 42.90 | 43.00 | 42.60 | 42.50 | 42.80 | 42.90 | 42.90 |
| 1978 | 43.10 | 43.30 | 43.70 | 43.60 | 43.60 | 43.20 | 43.30 | 43.40 | 43.40 | 43.60 | 43.40 | 43.70 |
| 1979 | 43.60 | 43.80 | 43.70 | 43.40 | 43.60 | 43.70 | 43.70 | 43.60 | 43.60 | 43.60 | 43.50 | 42.30 |
| 1980 | 42.00 | 39.30 | 38.60 | 38.40 | 37.90 | 37.60 | 37.30 | 31.60 | 30.60 | 29.00 | 28.70 | 27.70 |
| 1981 | 27.20 | 27.20 | 27.00 | 25.70 | 25.70 | 24.50 | 24.40 | 24.30 | 23.90 | 24.10 | 24.10 | 24.00 |
| 1982 | 24.00 | 23.70 | 23.40 | 22.60 | 22.70 | 21.50 | 20.30 | 19.10 | 17.30 | 17.00 | 17.55 | 18.80 |
| 1983 | 19.35 | **20.00** | | | | | | | | | | |

## HISTORICAL CONVERSION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. $U_6$)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1981 | 1.20 | 1.20 | 1.20 | 1.40 | 1.15 | 1.15 | 1.15 | 1.10 | 1.10 | 1.10 | 1.20 | 1.20 |
| 1982 | 1.20 | 1.20 | 1.20 | 1.20 | 1.00 | 1.00 | 1.00 | 0.90 | 1.10 | 1.60 | 1.45 | 1.45 |
| 1983 | 1.20 | **1.40** | | | | | | | | | | |

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## AUSTRALIA

| | Price Index of Materials Used in Manufacturing Industry—All Groups (Year 1968-69 = 100.0)[1] | Award Rates of Pay Indexes Australia—Adult Males In Mining Wage Earners, Weekly Rates (Year 1976 = 100.0)[2] |
|---|---|---|
| Annual Avg. 1971[3] | 101.5 | 65.95 |
| Annual Avg. 1972[3] | 105.6 | 71.26 |
| Annual Avg. 1973[3] | 124.4 | 78.96 |
| Annual Avg. 1974[3] | 141.9 | 108.07 |
| Annual Avg. 1975[3] | 150.4 | 132.55 |
| Annual Avg. 1976[3] | 168.4 | 160.93 |
| Annual Avg. 1977[3] | 192.0 | 179.03 |
| Annual Avg. 1978[3] | 198.5 | 190.04 |
| Annual Avg. 1979 | 248.8 | 196.34 |
| Annual Avg. 1980 | 321.8 | 218.00 |
| Annual Avg. 1981 | 355.3 | 237.34 |
| Sep 1981 | 358.4 | 155.0[2] |
| Oct 1981 | 352.5 | 155.6[2] |
| Nov 1981 | 351.3 | 157.5[2] |
| Dec 1981 | 349.9 | 167.4[2] |
| Jan 1982 | 354.9 | 169.0[2] |
| Feb 1982 | 356.7 | 170.6R[2] |
| Mar 1982 | 360.3 | 171.0R[2] |
| Apr 1982 | 367.7 | 170.9R[2] |
| May 1982 | 367.6 | 171.4R[2] |
| Jun 1982 | 367.2 | 172.7R[2] |
| Jul 1982 | 369.1 | 176.5R[2] |
| Aug 1982 | 371.5 | 177.1R[2] |
| Sep 1982 | 374.0 | 177.3R[2] |
| Oct 1982 | 377.2P | 177.4R[2] |
| Nov 1982 | 374.5P | 177.5[2] |

P = Preliminary    R = Revised since last month

[1] Australian Bureau of Statistics, Canberra: "Price Index of Materials Used in Manufacturing Industry" (Catalogue No. 6411.0), Table 3.

[2] Australian Bureau of Statistics, Canberra: "Award Rates of Pay Indexes, Australia" (Catalogue No. 6312.0), Table 8. Figures are being converted to an Index number. As the data are converted, the new index numbers will be inserted. Figures for the latest fourteen months shown are subject to revision.

[3] Monthly data for 1970 through 1978 appear on pages 4.7 and 4.8 of Nuexco Report 138.

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*GOVERNMENT STATISTICS*

## CANADA

| | Industry Selling Price Index: Manufacturing (D 500000)[1] [2] (1971 = 100.0) | Wage-earner Data: Average Hourly Earnings (C$)[4] [5] | | |
|---|---|---|---|---|
| | | Metal Mining, including Milling (SIC 050-099)[3] | Primary Metal Industries, non-ferrous (SIC 296-298) | Chemicals and Chemical Products (SIC 370-379) |
| Annual Avg. 1978 | 190.4 | 8.75R[3] | 6.82 | 6.97 |
| Annual Avg. 1979 | 217.9 | 9.66R[3] | 7.35 | 7.67 |
| Annual Avg. 1980 | 247.2 | 10.80R[3] | 8.05 | 8.50 |
| Annual Avg. 1981 | 288.7R | 12.23R[3] | 9.03 | 9.53 |
| Nov 1981 | 278.8 | 13.01R[3] | 9.45 | 9.89 |
| Dec 1981 | 280.0 | 12.96R[3] | 9.42 | 10.03 |
| Jan 1982 | 281.9 | 13.49R[3] | 9.53 | 10.11 |
| Feb 1982 | 283.5 | 13.61R[3] | 9.60 | 10.19 |
| Mar 1982 | 284.8 | 13.74R[3] | 9.62 | 10.35 |
| Apr 1982 | 287.7 | 13.81R[3] | 9.79 | 10.48 |
| May 1982 | 288.8 | 13.86R[3] | 9.88 | 10.62 |
| Jun 1982 | 289.7 | 13.83R[3] | 9.92 | 10.69 |
| Jul 1982 | 290.3 | 14.02R[3] | 10.05 | 10.73 |
| Aug 1982 | 290.2R | 14.23R[3] | 10.03 | 10.80 |
| Sep 1982 | 292.4R | 14.01R[3] | 10.18 | 10.73R |
| Oct 1982 | 292.1R | 13.95R[3] | 10.18R | 10.83R |
| Nov 1982 | 291.3R | 14.24P | 10.42P | 10.90P |
| Dec 1982 | 292.2R | — | — | — |

P = Preliminary    R = Revised since last month

[1] Statistics Canada, Prices Division, Ottawa; "Industry Price Indexes" (Catalogue 62-011), Table 1. Indexes for the most recent six months shown are subject to revision.

[2] Monthly data for 1973 through 1978 appear on page 4.10 of Nuexco Report 138.

[3] The wage earner series in previous Nuexco reports was Metals (SIC 050-059).

[4] Statistics Canada, Labour Division, Employment and Payrolls Section, Ottawa; "Employment, Earnings and Hours" (Catalogue 72-002), Table 2.

[5] Monthly data for 1977 and 1978 appear on page 4.11 of Nuexco Report 138.

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## REPUBLIC OF SOUTH AFRICA

| | Average Declared Working Costs per Metric Ton of Gold Ore Milled (Rand)[1] | Consumer Price Index[2] (1975 = 100, except where otherwise indicated) | Producer[5] Price Index All Groups (1975 = 100) | Total Employment in Mining and Quarrying (Code 35)[7] | Total Salaries and Wages in Mining and Quarrying (1,000 Rand) (Code 40)[7] |
|---|---|---|---|---|---|
| Annual Avg. 1971[3] | 7.88 | 106.4[4] | 59.1 | 652,294 | 415,956 |
| Annual Avg. 1972[3] | 8.79 | 113.3[4] | 63.9 | 623,067 | 443,933 |
| Annual Avg. 1973[3] | 10.51 | 124.1[4] | 72.3 | 684,743 | 572,133 |
| Annual Avg. 1974[3] | 13.18 | 138.5[4] | 85.3 | 674,140 | 761,596 |
| Annual Avg. 1975[3] | 16.71 | 157.2[4] | 100.0 | 639,473 | 1,003,617 |
| Annual Avg. 1976[3] | 19.30 | 174.7[4] | 115.1 | 671,240 | 1,212,983 |
| Annual Avg. 1977[3] [6] | 23.87 | 194.4[4] | 130.0 | 712,006 | 1,420,670 |
| Annual Avg. 1978[3] [6] | 27.14 | 137.2 | 142.7 | 664,571 | 1,537,169 |
| Annual Avg. 1979[3] [6] | 30.18 | 155.3 | 164.5 | 692,209 | 1,830,632 |
| Annual Avg. 1980[6] | 35.53 | 176.7 | 192.1 | 714,379 | 2,279,615 |
| Annual Avg. 1981 | 41.89 | 206.5 | 218.3 | 728,506 | 2,820,505 |
| Aug 1981 | — | 208.0 | 222.6 | 722,684 | 245,817 |
| Sep 1981 | 43.28 | 211.6 | 224.6 | 724,604 | 251,502 |
| Oct 1981 | — | 213.4 | 227.0 | 717,918 | 248,159 |
| Nov 1981 | — | 214.8 | 229.4 | 720,255 | 253,044 |
| Dec 1981 | 44.52 | 216.3 | 230.4 | 709,612 | 257,655 |
| Jan 1982 | — | 217.6 | 233.1 | 700,375 | 257,173 |
| Feb 1982 | — | 220.2 | 236.8 | 705,992 | 250,191 |
| Mar 1982 | 45.49 | 225.2 | 237.4 | 725,700 | 262,210 |
| Apr 1982 | — | 228.9 | 241.9 | 707,502 | 252,562 |
| May 1982 | — | 230.3 | 244.8 | 715,162 | 258,770 |
| Jun 1982 | 45.77 | 232.1 | 246.7 | 707,552 | 261,361 |
| Jul 1982 | — | 234.1 | 249.4 | 702,141 | 283,248 |
| Aug 1982 | — | 236.8 | 253.4 | 705,562 | 276,730 |
| Sep 1982 | 48.04 | 241.0 | 255.0 | 704,490 | 281,331 |
| Oct 1982 | — | 243.9 | 260.1 | — | — |
| Nov 1982 | — | 245.4 | 262.5 | — | — |
| Dec 1982 | 49.62 | 246.2 | 263.0 | — | — |
| Jan 1983 | — | 249.0 | — | — | — |

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[1] Chamber of Mines of South Africa, Johannesburg; "Analysis of Working Results," published quarterly.

[2] Republic of South Africa Department of Statistics, Pretoria; "Government Gazette: Consumer Price Index for Urban Areas."

[3] Historical data for the Average Declared Working Costs and Consumer Price Index 1970-1979 appear on page 4.9 of Nuexco Report 140.

[4] April 1970 = 100.00.

[5] Previously known as the WHOLESALE PRICE INDEX, now the PRODUCER PRICE INDEX. The computation remains the same.

[6] Historical data for Codes 35 and 40 1977-1980 appear on page 28 of Nuexco Report 157.

[7] Bulletin of Statistics, Department of Statistics, Pretoria.

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## *GOVERNMENT STATISTICS*

### UNITED STATES

| | Producer Price Index— Industrial Commodities (1967 = 100)[1] | Producer Price Index— All Commodities (1967 = 100)[1] | Consumer Price Index (1967 = 100)[2] | GNP Implicit Price Deflator (1972 = 100)[3] | Gross Average Hourly Earnings of Production or Non-supervisory Workers (US$)[4] | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Metal Mining (SIC 10) | Primary Non-ferrous Metals (SIC 333) | Chemicals and Allied Products (SIC 28) | Electric and Electronic Equipment (SIC 36) |
| Annual Avg. 1972[5] | 117.9 | 119.1 | 125.3 | 100.00 | 4.56 | 4.59 | 4.26 | 3.71 |
| Annual Avg. 1973[5] | 125.9 | 134.7 | 133.1 | 105.75 | 4.84 | 4.98 | 4.51 | 3.91 |
| Annual Avg. 1974[5] | 153.8 | 160.1 | 147.7 | 115.08 | 5.44 | 5.63 | 4.88 | 4.21 |
| Annual Avg. 1975[5] | 171.5 | 174.9 | 161.2 | 125.79 | 6.13 | 6.24 | 5.39 | 4.64 |
| Annual Avg. 1976[5] | 182.4 | 183.0 | 170.5 | 132.34 | 6.76 | 6.87 | 5.91 | 4.96 |
| Annual Avg. 1977[5] | 195.1 | 194.2 | 181.5 | 140.05 | 7.28 | 7.67 | 6.43 | 5.39 |
| Annual Avg. 1978[5] | 209.4 | 209.3 | 195.4 | 150.42 | 8.23 | 8.56 | 7.02 | 5.82 |
| Annual Avg. 1979[5] | 236.5 | 235.6 | 217.4 | 163.42 | 9.27 | 9.50 | 7.60 | 6.32 |
| Annual Avg. 1980[5] | 274.8 | 268.8 | 246.8 | 178.64 | 10.26 | 10.63 | 8.30 | 6.94 |
| Annual Avg. 1981 | 304.1 | 293.4 | 272.4 | 195.51 | 11.55 | 11.98 | 9.12 | 7.62 |
| Annual Avg. 1982 | 312.3P | 299.3P | 289.1 | 207.15R | — | — | 9.98P | 8.17P |
| Jan 1982 | 311.7 | 298.2 | 282.5 | — | 12.19 | 12.66 | 9.68 | 7.98 |
| Feb 1982 | 311.4 | 298.5 | 283.4 | — | 12.22 | 12.61 | 9.68 | 7.96 |
| Mar 1982 | 311.0 | 298.0 | 283.1 | 203.68 | 12.29 | 12.69 | 9.71 | 8.01 |
| Apr 1982 | 309.9 | 298.0 | 284.3 | — | 12.23 | 12.68 | 9.81 | 8.03 |
| May 1982 | 309.6 | 298.6 | 287.1 | — | 12.25 | 12.71 | 9.83 | 8.05 |
| Jun 1982 | 310.6 | 299.3 | 290.6 | 205.98 | 12.26 | 12.91 | 9.95 | 8.09 |
| Jul 1982 | 312.8 | 300.4 | 292.2 | — | 12.23 | 12.91 | 10.02 | 8.18 |
| Aug 1982 | 313.2 | 300.2 | 292.8 | — | 12.29 | 12.97 | 10.03 | 8.24 |
| Sep 1982 | 312.7R | 299.3R | 293.3 | 208.51 | 12.53 | 13.46 | 10.20 | 8.31 |
| Oct 1982 | 314.4P | 299.9P | 294.1 | — | 12.50 | 13.22 | 10.24 | 8.34 |
| Nov 1982 | 315.1P | 300.4P | 293.6 | — | 12.52R | 13.18R | 10.28R | 8.38 |
| Dec 1982 | 315.0P | 300.6P | 292.4 | 210.42R | 12.51R | 13.04P | 10.34R | 8.47R |
| Jan 1983 | 314.0P | 300.0P | 293.1 | — | — | — | 10.35P | 8.47P |

P = Preliminary R = Revised since last month

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[1] US Bureau of Labor Statistics, Washington, D.C.; "Producer Prices and Price Indexes," Table 6 (formerly "Wholesale Prices and Price Indexes"). Producer Price Indexes are revised four months after they are first released to reflect the availability of late reports and corrections by respondents.

[2] US Bureau of Labor Statistics, Washington, D.C.; Consumer Price Index for All Urban Consumers, US City Average, All Items.

[3] US Department of Commerce, Washington, D.C.; Bureau of Economic Analysis, National Income and Wealth Division; "Survey of Current Business," Table A. The GNP Implicit Price Deflator is published quarterly, and seasonally adjusted.

[4] US Bureau of Labor Statistics, Washington, D.C.; "Employment and Earnings," Table C-2. All data based on 1972 revision of SIC Manual. Data for 1970-1976 are adjusted to the March 1977 benchmark. Data for 1977-1978 are adjusted to the March 1979 benchmark. Data for January 1979 and beyond are adjusted to the March 1980 benchmark.

[5] Monthly data 1970-1978 for Producer Price Index-Industrial Commodities, Consumer Price Index, and Employment and Earnings SIC codes 10, 333, and 28, and quarterly data for GNP Implicit Price Deflator appear on pages 4.6-4.8 of Nuexco Report 139.
Monthly data 1977-1978 for Employment and Earnings SIC Codes 10, 333, and 28 appear on page 33 of Nuexco Report 147.
Monthly data 1970-1978 for Employment and Earnings SIC Code 36 appear on page 23 of Nuexco Report 154.
Monthly data 1979-1980 for Employment and Earnings, Revised Establishment Data, all listed codes, appear on page 22 of Nuexco Report 158.
Monthly data 1977-1980 for Producer Price Index-All Commodities, appear on page 21 of Nuexco Report 158.

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## Table 13A

## COST OF ENRICHED URANIUM (US $ per KgU as UF₆, 3 percent U235) FOR VARIOUS COMBINATIONS OF FEED AND SWU COSTS (0.20% TA)

| Feed Cost (US $ per KgU as Natural UF₆) | SWU Price (US $ per SWU) 90 | 95 | 100 | 105 | 110 | 115 | 120 | 125 | 130 |
|---|---|---|---|---|---|---|---|---|---|
| 40 | 606.75 | 628.29 | 649.82 | 671.35 | 692.88 | 714.42 | 735.95 | 757.48 | 779.01 |
| 45 | 634.15 | 655.68 | 677.22 | 698.75 | 720.28 | 741.81 | 763.35 | 784.88 | 806.41 |
| 50 | 661.55 | 683.08 | 704.61 | 726.15 | 747.68 | 769.21 | 790.74 | 812.28 | 833.81 |
| 55 | 688.95 | 710.48 | 732.01 | 753.54 | 775.08 | 796.61 | 818.14 | 839.67 | 861.20 |
| 60 | 716.34 | 737.88 | 759.41 | 780.94 | 802.47 | 824.01 | 845.54 | 867.07 | 888.60 |
| 65 | 743.74 | 765.27 | 786.81 | 808.34 | 829.87 | 851.40 | 872.93 | 894.47 | 916.00 |
| 70 | 771.14 | 792.67 | 814.20 | 835.73 | 857.27 | 878.80 | 900.33 | 921.86 | 943.40 |
| 75 | 798.53 | 820.07 | 841.60 | 863.13 | 884.66 | 906.20 | 927.73 | 949.26 | 970.79 |
| 80 | 825.93 | 847.46 | 869.00 | 890.53 | 912.06 | 933.59 | 955.13 | 976.66 | 998.19 |
| 85 | 853.33 | 874.86 | 896.39 | 917.93 | 939.46 | 960.99 | 982.52 | 1,004.06 | 1,025.59 |
| 90 | 880.73 | 902.26 | 923.79 | 945.32 | 966.86 | 988.39 | 1,009.92 | 1,031.45 | 1,052.99 |
| 95 | 908.12 | 929.66 | 951.19 | 972.72 | 994.25 | 1,015.79 | 1,037.32 | 1,058.85 | 1,080.38 |
| 100 | 935.52 | 957.05 | 978.59 | 1,000.12 | 1,021.65 | 1,043.18 | 1,064.72 | 1,086.25 | 1,107.78 |
| | 90 | 95 | 100 | 105 | 110 | 115 | 120 | 125 | 130 |
| 105 | 962.92 | 984.45 | 1,005.98 | 1,027.52 | 1,049.05 | 1,070.58 | 1,092.11 | 1,113.65 | 1,135.18 |
| 110 | 990.32 | 1,011.85 | 1,033.38 | 1,054.91 | 1,076.45 | 1,097.98 | 1,119.51 | 1,141.04 | 1,162.57 |
| 115 | 1,017.71 | 1,039.25 | 1,060.78 | 1,082.31 | 1,103.84 | 1,125.37 | 1,146.91 | 1,168.44 | 1,189.97 |
| 120 | 1,045.11 | 1,066.64 | 1,088.18 | 1,109.71 | 1,131.24 | 1,152.77 | 1,174.30 | 1,195.84 | 1,217.37 |
| 125 | 1,072.51 | 1,094.04 | 1,115.57 | 1,137.10 | 1,158.64 | 1,180.17 | 1,201.70 | 1,223.23 | 1,244.77 |
| 130 | 1,099.90 | 1,121.44 | 1,142.97 | 1,164.50 | 1,186.03 | 1,207.57 | 1,229.10 | 1,250.63 | 1,272.16 |
| 135 | 1,127.30 | 1,148.83 | 1,170.37 | 1,191.90 | 1,213.43 | 1,234.96 | 1,256.50 | 1,278.03 | 1,299.56 |
| 140 | 1,154.70 | 1,176.23 | 1,197.76 | 1,219.30 | 1,240.83 | 1,262.36 | 1,283.89 | 1,305.43 | 1,326.96 |
| 145 | 1,182.10 | 1,203.63 | 1,225.16 | 1,246.69 | 1,268.23 | 1,289.76 | 1,311.29 | 1,332.82 | 1,354.36 |
| 150 | 1,209.49 | 1,231.03 | 1,252.56 | 1,274.09 | 1,295.62 | 1,317.16 | 1,338.69 | 1,360.22 | 1,381.75 |
| 155 | 1,236.89 | 1,258.42 | 1,279.96 | 1,301.49 | 1,323.02 | 1,344.55 | 1,366.09 | 1,387.62 | 1,409.15 |
| 160 | 1,264.29 | 1,285.82 | 1,307.35 | 1,328.89 | 1,350.42 | 1,371.95 | 1,393.48 | 1,415.02 | 1,436.55 |

## OPTIMUM TAILS ASSAY FOR VARIOUS COMBINATIONS OF FEED AND SWU COSTS

(percent U235)

| Feed Cost (US$ per KgU as Natural UF₆) | SWU Price (US $ per SWU) 90 | 95 | 100 | 105 | 110 | 115 | 120 | 125 | 130 | 138.65 | 140 | 149.85 | 160 | 170 | 180 | 190 | 200 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 40 | .316 | .322 | .327 | .333 | .338 | .343 | .347 | .352 | .356 | .363 | .364 | .372 | .379 | .385 | .391 | .397 | .402 |
| 45 | .302 | .308 | .314 | .320 | .325 | .330 | .334 | .339 | .343 | .350 | .351 | .359 | .366 | .373 | .379 | .384 | .390 |
| 50 | .291 | .297 | .302 | .308 | .313 | .318 | .323 | .327 | .332 | .339 | .340 | .347 | .354 | .361 | .367 | .373 | .379 |
| 55 | .280 | .286 | .292 | .297 | .302 | .307 | .312 | .317 | .321 | .328 | .329 | .337 | .344 | .351 | .357 | .363 | .368 |
| 60 | .271 | .277 | .282 | .288 | .293 | .298 | .302 | .307 | .311 | .319 | .320 | .327 | .334 | .341 | .347 | .353 | .359 |
| 65 | .262 | .268 | .273 | .279 | .284 | .289 | .294 | .298 | .302 | .310 | .311 | .318 | .326 | .332 | .339 | .345 | .350 |
| 70 | .254 | .260 | .265 | .271 | .276 | .281 | .285 | .290 | .294 | .301 | .302 | .310 | .317 | .324 | .330 | .336 | .342 |
| 75 | .246 | .252 | .258 | .263 | .268 | .273 | .278 | .282 | .287 | .294 | .295 | .302 | .310 | .316 | .323 | .329 | .334 |
| 80 | .239 | .245 | .251 | .256 | .261 | .266 | .271 | .275 | .279 | .287 | .288 | .295 | .302 | .309 | .316 | .322 | .327 |
| 85 | .233 | .239 | .244 | .249 | .254 | .259 | .264 | .268 | .273 | .280 | .281 | .288 | .296 | .302 | .309 | .315 | .321 |
| 90 | .227 | .232 | .238 | .243 | .248 | .253 | .258 | .262 | .266 | .274 | .275 | .282 | .289 | .296 | .302 | .308 | .314 |
| 95 | .221 | .227 | .232 | .237 | .242 | .247 | .252 | .256 | .260 | .268 | .269 | .276 | .283 | .290 | .296 | .302 | .308 |
| 100 | .216 | .221 | .227 | .232 | .237 | .242 | .246 | .251 | .255 | .262 | .263 | .270 | .278 | .284 | .291 | .297 | .302 |

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## Table 13B

## COST OF ENRICHED URANIUM (US $ per KgU as $UF_6$, 3 percent $U_{235}$) FOR VARIOUS COMBINATIONS OF FEED AND SWU COSTS (0.20% TA)

| Feed Cost (US $ per KgU as Natural $UF_6$) | SWU Price (US $ per SWU) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 138.65 | 140 | 149.85 | 160 | 170 | 180 | 190 | 200 |
| 40 | 816.26 | 822.08 | 864.50 | 908.21 | 951.27 | 994.34 | 1,037.40 | 1,080.47 |
| 45 | 843.66 | 849.48 | 891.89 | 935.60 | 978.67 | 1,021.73 | 1,064.80 | 1,107.86 |
| 50 | 871.06 | 876.87 | 919.29 | 963.00 | 1,006.07 | 1,049.13 | 1,092.20 | 1,135.26 |
| 55 | 898.46 | 904.27 | 946.69 | 990.40 | 1,033.46 | 1,076.53 | 1,119.59 | 1,162.66 |
| 60 | 925.85 | 931.67 | 974.09 | 1,017.80 | 1,060.86 | 1,103.93 | 1,146.99 | 1,190.06 |
| 65 | 953.25 | 959.06 | 1,001.48 | 1,045.19 | 1,088.26 | 1,131.32 | 1,174.39 | 1,217.45 |
| 70 | 980.65 | 986.46 | 1,028.88 | 1,072.59 | 1,115.66 | 1,158.72 | 1,201.79 | 1,244.85 |
| 75 | 1,008.84 | 1,013.86 | 1,056.28 | 1,099.99 | 1,143.05 | 1,186.12 | 1,229.18 | 1,272.25 |
| 80 | 1,035.44 | 1,041.26 | 1,083.67 | 1,127.39 | 1,170.45 | 1,213.51 | 1,256.58 | 1,299.64 |
| 85 | 1,062.84 | 1,068.65 | 1,111.07 | 1,154.78 | 1,197.85 | 1,240.91 | 1,283.98 | 1,327.04 |
| 90 | 1,090.24 | 1,096.05 | 1,138.47 | 1,182.18 | 1,225.24 | 1,268.31 | 1,311.37 | 1,354.44 |
| 95 | 1,117.63 | 1,123.45 | 1,165.87 | 1,209.58 | 1,252.64 | 1,295.71 | 1,338.77 | 1,381.84 |
| 100 | 1,145.03 | 1,150.85 | 1,193.26 | 1,236.97 | 1,280.04 | 1,323.10 | 1,366.17 | 1,409.23 |
| | 138.65 | 140 | 149.85 | 160 | 170 | 180 | 190 | 200 |
| 105 | 1,172.43 | 1,178.24 | 1,220.66 | 1,264.37 | 1,307.44 | 1,350.50 | 1,393.57 | 1,436.63 |
| 110 | 1,199.83 | 1,205.64 | 1,248.06 | 1,291.77 | 1,334.83 | 1,377.90 | 1,420.96 | 1,464.03 |
| 115 | 1,227.22 | 1,233.04 | 1,275.46 | 1,319.17 | 1,362.23 | 1,405.30 | 1,448.36 | 1,491.43 |
| 120 | 1,254.62 | 1,260.43 | 1,302.85 | 1,346.56 | 1,389.63 | 1,432.69 | 1,475.76 | 1,518.82 |
| 125 | 1,282.02 | 1,287.83 | 1,330.25 | 1,373.96 | 1,417.03 | 1,460.09 | 1,503.16 | 1,546.22 |
| 130 | 1,309.41 | 1,315.23 | 1,357.65 | 1,401.36 | 1,444.42 | 1,487.49 | 1,530.55 | 1,573.62 |
| 135 | 1,336.81 | 1,342.63 | 1,385.04 | 1,428.76 | 1,471.82 | 1,514.88 | 1,557.95 | 1,601.01 |
| 140 | 1,364.21 | 1,370.02 | 1,412.44 | 1,456.15 | 1,499.22 | 1,542.28 | 1,585.35 | 1,628.41 |
| 145 | 1,391.61 | 1,397.42 | 1,439.84 | 1,483.55 | 1,526.61 | 1,569.68 | 1,612.74 | 1,655.81 |
| 150 | 1,419.00 | 1,424.82 | 1,467.24 | 1,510.95 | 1,554.01 | 1,597.08 | 1,640.14 | 1,683.21 |
| 155 | 1,446.40 | 1,452.21 | 1,494.63 | 1,538.34 | 1,581.41 | 1,624.47 | 1,667.54 | 1,710.60 |
| 160 | 1,473.80 | 1,479.61 | 1,522.03 | 1,565.74 | 1,608.81 | 1,651.87 | 1,694.94 | 1,738.00 |

## OPTIMUM TAILS ASSAY FOR VARIOUS COMBINATIONS OF FEED AND SWU COSTS

(percent $U_{235}$)

| Feed Cost (US$ per KgU as Natural $UF_6$) | SWU Price (US $ per SWU) | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 90 | 95 | 100 | 105 | 110 | 115 | 120 | 125 | 130 | 138.65 | 140 | 149.85 | 160 | 170 | 180 | 190 | 200 |
| 105 | .211 | .216 | .222 | .227 | .232 | .236 | .241 | .245 | .250 | .257 | .258 | .265 | .272 | .279 | .285 | .291 | .297 |
| 110 | .206 | .211 | .217 | .222 | .227 | .231 | .236 | .240 | .245 | .252 | .253 | .260 | .267 | .274 | .280 | .286 | .292 |
| 115 | .201 | .207 | .212 | .217 | .222 | .227 | .231 | .236 | .240 | .247 | .248 | .255 | .262 | .269 | .275 | .281 | .287 |
| 120 | .197 | .202 | .208 | .213 | .218 | .222 | .227 | .231 | .235 | .242 | .243 | .250 | .258 | .264 | .271 | .277 | .282 |
| 125 | .193 | .198 | .204 | .209 | .213 | .218 | .222 | .227 | .231 | .238 | .239 | .246 | .253 | .260 | .266 | .272 | .278 |
| 130 | .189 | .194 | .200 | .205 | .209 | .214 | .218 | .223 | .227 | .234 | .235 | .242 | .249 | .256 | .262 | .268 | .273 |
| 135 | .185 | .191 | .196 | .201 | .205 | .210 | .214 | .219 | .223 | .230 | .231 | .238 | .245 | .251 | .258 | .264 | .269 |
| 140 | .182 | .187 | .192 | .197 | .202 | .206 | .211 | .215 | .219 | .226 | .227 | .234 | .241 | .247 | .254 | .260 | .265 |
| 145 | .178 | .184 | .189 | .194 | .198 | .203 | .207 | .211 | .215 | .222 | .223 | .230 | .237 | .244 | .250 | .256 | .261 |
| 150 | .175 | .180 | .185 | .190 | .195 | .199 | .204 | .208 | .212 | .218 | .219 | .227 | .234 | .240 | .246 | .252 | .258 |
| 155 | .172 | .177 | .182 | .187 | .192 | .196 | .200 | .204 | .208 | .215 | .216 | .223 | .230 | .237 | .243 | .248 | .254 |
| 160 | .169 | .174 | .179 | .184 | .188 | .193 | .197 | .201 | .205 | .212 | .213 | .220 | .227 | .233 | .239 | .245 | .251 |

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NUEXCO

# EXECUTIVE SUMMARY
## REPORT 176

| | |
|---|---|
| **Exchange Value Rose $0.50, to $22.25** | The **Exchange Value** as of March 31, 1983 is **$22.25** per pound $U_3O_8$. Six spot or near-term sales are reported, involving approximately 1.1 million pounds $U_3O_8$, *equivalent*. |
| **Near-term Supply-Demand Ratio Dropped to 2.6:1** | Active spot and near-term **uranium supply** amounts to **7.5 million** pounds $U_3O_8$, *equivalent*, down 13% from last month. **Active** spot and near-term **uranium demand** increased slightly to **2.9 million** pounds $U_3O_8$ equivalent. Therefore, the spot and near-term **supply-demand ratio** declined 16 percent, to **2.6:1**. |
| **Transaction Value Rose $1.35, to $21.35** | The **Transaction Value** as of March 31, 1983 is **$21.35** per pound $U_3O_8$. It includes 12 transactions involving a total of 2.8 million pounds $U_3O_8$ and covers a period of three months. |
| **Conversion Value Unchanged at $1.40** | The **Conversion Value** as of March 31, 1983 is **$1.40** per pound U as $UF_6$, unchanged since last month. One small conversion transaction is reported. Active sellers are offering 3.0 million pounds U in near-term conversion services, up 15% since last month. Active demand declined 20%, to 735 thousands pounds U. |
| **Loan Use Charge Rate Steady at 6%** | The **Loan Use Charge Rate** as of March 31, 1983 is **6 percent** per annum. No loan transactions are reported. This segment of the market remains quiet. |
| **SWU Values:**<br>**FY 83 $106, up $3**<br>**FY 84 $110, unchanged** | As of March 31, 1983, the **SWU Value for FY83** is **$106 per SWU** and the **SWU Value for FY84** is **$110**. Those prices reflect some price hardening by sellers of large quantities of Eurodif SWUs, in response to a decrease in competing DOE supply. Prices offered by those few sellers of DOE SWU remaining in the market are approximately $120 per SWU. The only potential buyers for sizable blocks of FY83 SWU on the secondary market are holders of DOE requirements contracts having 3.5-year termination provisions. However, there are very few who would be willing to terminate at this late date in order to enter the secondary market.<br>For FY84 SWUs, there is no large differential between prices being offered by sellers of DOE and Eurodif SWUs. This segment of the market is the most active at present. The market for FY85 and beyond remains quiet, awaiting DOE's revelation of the terms and conditions of conversion to the FR contract. |
| **Africa** | Summarizes **Niger's** 1982 uranium sales.<br>Presents excerpts from uranium market comments by senior mining house officials in **South Africa**. |
| **Australia** | Discusses implications of Labor Party's election victory. |
| **Japan** | Annual price negotiations with African suppliers yield prices of approximately $33.50-34.50 for 1984. |
| **United States** | Presents edited remarks of Nuexco President George White, Jr. at AIF Fuel Cycle meeting in Kansas City. |
| **Raw Materials** | Updates exploration in the Arizona Strip, with emphasis on breccia pipes. |

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# NUEXCO REPORT 176
## FIGURES OF THE MONTH
(March 31, 1983)

| | This Month (Report 176) | Last Month (Report 175) | 12 Months Ago (Report 164) |
|---|---|---|---|
| Exchange Value[1] | 22.25 | 21.75 | 22.50 |
| Transaction Value[1] | 21.35 | 20.00 | 23.40 |
| Conversion Value[2] | 1.40 | 1.40 | 1.20 |
| Loan Use Charge Rate[3] | 6% | 6% | 6% |
| Near-Term Uranium Supply[4] | 7.5 | 8.6 | 11.2 |
| Near-Term Uranium Demand[5] | 2.9 | 2.8 | 2.2 |
| Near-Term Supply-Demand Ratio | 2.6 | 3.1 | 5.2 |
| Current Transactions[6]: | | | |
| Number of Transactions | 7 | 5 | 6 |
| Quantity of Material[7] | 6.7-7.4+ | 0.8-1.8 | 0.6-1.4 |
| SWU Prices[8]: | | | |
| Nuexco SWU Values: | | | |
| FY 83 | 106 | 103 | — |
| FY 84 | 110 | 110 | — |
| USDOE SWU Prices: | | | |
| AFC | 138.65 | 138.65 | 130.75 |
| Requirements | 149.85 | 149.85 | 138.37 |
| Market Value of Enriched $UF_6$[9] [10]: | | | |
| 2.5 w/o $U_{235}$ | 616.48 | 600.94 | — |
| 3.0 w/o $U_{235}$ | 790.32 | 770.28 | — |
| 3.5 w/o $U_{235}$ | 967.34 | 942.70 | — |
| 4.0 w/o $U_{235}$ | 1,146.70 | 1,117.40 | — |

---

[1] US $ per pound $U_3O_8$ equivalent

[2] US $ per pound U as $UF_6$

[3] Per annum

[4] Active inquiries to sell, for delivery within 12 months after contract signing (millions of pounds $U_3O_8$)

[5] Active inquiries to purchase, for delivery within 12 months after contract signing (millions of pounds $U_3O_8$)

[6] Uranium transactions only; does not include loans, conversion, or SWU transactions

[7] Millions of pounds $U_3O_8$, equivalent

[8] US $ per SWU

[9] Calculated using the Nuexco Exchange Value, Conversion Value, and 0.20 percent tails assay. Calculations before 2/28/83 used the USDOE price for AFC SWUs. As of 2/28/83, calculations use the Nuexco SWU Value for the relevant fiscal year (currently FY 83).

[10] US $ per KgU as $UF_6$

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# NUEXCO

## MONTHLY REPORT ON THE URANIUM MARKET

April 1983 No. 176

R. WESLEY MILLER, *EDITOR*

*PRICING*

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## FOREWORD

It is with regret that we announce the resignation of Sanford C. Anderson from Nuexco. Sandy will be pursuing a new career outside the nuclear field, but will remain associated with Nuexco as a special consultant. Having been associated with us for ten years, he will be missed by friends, colleagues and customers. We all wish him well.

## NATURAL URANIUM AND CONVERSION

The **Exchange Value** as of March 31, 1983 rose for the sixth consecutive month, to **$22.25** per pound $U_3O_8$, up $0.50 since last month. Market activity during March was spread over a wide range between $21.50 and $23.75 per pound $U_3O_8$.

The *Current Market Data* section lists seven uranium sales transactions, amounting to more than 20 million pounds $U_3O_8$, equivalent. The six spot or near-term transactions accounted for approximately 1.1 million pounds of the total.

**Active spot and near-term uranium supply** (material offered at competitive prices, terms, and other conditions) amounts to **7.5** million pounds $U_3O_8$ equivalent, down 13 percent from last month's level of 8.6 million. **Active spot and near-term uranium demand** increased slightly to **2.9** million pounds $U_3O_8$, equivalent. The spot and near-term **supply-demand ratio** declined to **2.6:1**, 16 percent lower than last month's level of 3.1.

* * *

The **Transaction Value** as of March 31, 1983 is **$21.35** per pound $U_3O_8$, equivalent. The increase of $1.35 is attributable to the fact that transactions from December 1982 are no longer included in the sample. That month's transactions included a large quantity of material sold at prices substantially lower than the current Exchange Value or Transaction Value. The current Transaction Value includes 12 transactions involving a total of 2.8 million pounds $U_3O_8$ equivalent, and covers a period of three months.

* * *

The **Conversion Value** as of March 31, 1983 is **$1.40** per pound U as $UF_6$, unchanged from last month. **Spot and near-term conversion supply** (active inquiries to sell conversion services within one year) total **3.0 million** pounds U, up 15 percent since last month. **Spot and near-term conversion demand** declined by approximately 20 percent, to **735 thousand** pounds U. The *Current Market Data* section lists one conversion transaction this month, for 100-300 thousand pounds U.

* * *

The **Loan Use Charge Rate** remained at six percent per annum. Several million pounds $U_3O_8$ are available for loan at or near the current level, but there are few potential borrowers. No loan transations are reported this month.

* * *

With its sixth consecutive monthly increase, the **Exchange Value** has rebounded to $22.25 per pound $U_3O_8$, approximately one-third higher than the recent low of $17.00 which occurred last year as of August 31 and September 30. However, to expect a sustained price rise would be to ignore the economic factors that ultimately drive the market. Buyers and sellers alike seem to share the perception that the fundamentals of supply and demand argue against a sustained price rise. Nevertheless, the market is characterized by behavior that *appears* to refute that perception. Buyers and sellers act as though they believe spot and near-term market prices will continue increasing for some indefinite period of time. The following examples serve to illustrate the *apparently* contradictory behavior which characterizes the current market.

1. Buyers are entering the market, primarily for intermediate- and long-term supplies.
2. In many cases, the movements into and out of the market by potential buyers and sellers seem to be driven more by their perceptions of the prevailing "market psychology" than by market fundamentals, financial considerations, or (in the case of buyers) by their actual need for uranium.
3. While spot and near-term transactions in March amounted to 1.1 million pounds $U_3O_8$, additions to demand more than offset additions to supply, such that the near-term supply-demand ratio declined by approximately one-sixth from the previous month.
4. There are a number of producers holding substantial inventories off the market, presumably in the expectation of obtaining higher prices later.
5. Those sellers who are active have been moving their offering prices higher from month to month, and even from offer to offer.
6. Buyers having need of spot or near-term supplies seem to be adopting more flexible negotiating postures, especially with regard to price, apparently in expectation of higher prices in the near future.
7. Believing that spot and near-term market prices will continue to rise for some time, some buyers have entered the market well in advance of need, hoping to obtain material at prices that will look very attractive later.

A word of caution is in order. The outlook for all uranium prices is more uncertain than it might seem. The recent, modest recovery of spot and near-term prices

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could stop as suddenly as it began. If producers continue to shut down, cut back and postpone additions to capacity, a perceived shortage of production capacity could develop in the middle of this decade sufficient to stimulate substantial increases in prices for long-term contracts. On the other hand, holders of large quantities of inventory could sell or consume their excess, imposing strong downward pressure on the longer-term market as well as on the spot and near-term markets.

History has shown that the uranium market, having few participants and few transactions, is subject to large price swings. To the extent that a consensus develops with regard to future price behavior, those expectations can be self-fulfilling. In that event, the uranium price cycle would likely pass through higher peaks and lower valleys than would otherwise have occurred, both for spot/near-term prices and for longer-term prices. So long as uranium prices can be affected so strongly by any one of numerous conflicting influences, the possibility of extreme movements in either direction shrouds the future in uncertainty.

## ENRICHED URANIUM AND SWUs

As of March 31, 1983 the **SWU Value for FY 1983** is **$106 per SWU**, up $3 from a month ago. This price rise reflects some price hardening by sellers of large quantities of Eurodif SWU in response to a decrease in competing DOE market supply. In recent months, in order to be competitive, Eurodif sellers have had to offer substantial discounts below the prices offered by DOE secondary market sellers. There are now, however, virtually no DOE secondary market SWU available for FY 1983 at competitive prices, so Eurodif sellers have been raising their offering prices and hardening their negotiating postures somewhat.

The potential market for sizable blocks of SWU for FY 1983 delivery is still comprised of those DOE customers holding requirements contracts having 3.5-year termination provisions. Among that group, there are very few, if any, having FY 1983 deliveries who would be willing to terminate at this late date and buy replacement SWU on the secondary market. DOE's standard policy requires 6 months' notice for the specification of enrichment assays and quantities to be delivered, so most such buyers who were willing to use the secondary market have already terminated and purchased replacement SWU before the six-month deadline. It is highly unlikely that many new such buyers will enter the market at this late stage.

The few sellers of DOE SWU for FY 1983 delivery are presently offering at approximately $120 per SWU (at 0.20 percent tails assay). They are primarily holders of enriched product inventory wishing to sell SWU by means of de-enrichment swaps. There is little interest at present for buyers in completing transactions at this price level. However, there are some potential buyers of FY 1983 SWUs seeking small quantities in excess of their requirements contract appendix A ceilings or due to unexpected changes in their fuel needs. Such buyers will likely have to pay prices substantially above $106, the current SWU Value for FY 1983, if such purchases are made from DOE customers.

As of March 31, 1983 the **SWU Value for FY 1984 is $110 per SWU**, unchanged since last month. The price reflects SWU prices available for delivery in FY 1984 from both Eurodif and DOE SWU sellers. This segment of the secondary SWU market is very active. Demand increased substantially for FY 1984 this month as a number of buyers holding DOE requirements contracts having 3.5-year termination provisions began seeking secondary market supply to replace deliveries scheduled for mid-to-late FY 1984. These buyers hope to complete secondary market SWU purchases in time to allow them to terminate their FY 1984 requirements contract deliveries with more than one year's notice. It appears probable that most DOE FY 1984 SWUs now available on the secondary market at competitive prices will be sold within the next few months. In that event, the remaining DOE 3.5-year requirements contract holders who wish to terminate in FY 1984 could face the same choice that many faced in FY 1983, that of whether to accept full-priced supply from DOE or to purchase discounted SWU produced by another enricher.

The market for FY 1985 and later remains quiet, as it has for the past several months. Potential sellers await DOE's announcement of the terms and conditions of conversion to the FR (Facility Requirements) contract. That announcement is expected in late April or early May.

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## *CURRENT MARKET DATA*

**EXCHANGE VALUE $22.25/lb. $U_3O_8$**
Determined as of March 31, 1983

**Definition**[1]

The Exchange Value is Nuexco's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the last day of the month.

**Derivation**

Nuexco bases the Exchange Value upon:

A. Data from recently completed transactions.
B. Data from pending transactions.
C. Firm bids to buy and firm offers to sell.
D. Prices purchasers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy, and prices sellers have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell.

**Comments**

Nuexco does not consider the following in determining the Exchange Value:

A. The price of uranium delivered or to be delivered under old contracts.
B. The price of uranium delivered in connection with contract renegotiations or other than arm's length transactions.

[1] In December, 1981, Nuexco published a history of the Exchange Value which chronicled, month-by-month, changes in its definition, usage and derivation. Copies are available upon request.

**TRANSACTION VALUE**[2]
Determined as of March 31, 1983

| $/lb. $U_3O_8$ | Millions of Pounds | Number of Transactions | Number of Months |
|---|---|---|---|
| **21.35** | 2.8 | 12 | 3 |

**Definition**

The Transaction Value is a weighted average price of recent transactions, and is based on prices paid for $U_3O_8$ in transactions closed within the previous three-month period and for which delivery was scheduled within one year of the transaction date. At least ten transactions totaling at least two million pounds $U_3O_8$ are included in each calculation, or the sample time is extended as necessary to include these minima. Foreign currencies are converted to US dollars as of the transaction date.

**Comments**

Nuexco does not consider the following in determining the Transaction Value:

A. The price of uranium delivered in connection with contract renegotiations or other than arm's length transactions.
B. The price of uranium delivered in connection with contracts which call for "market price" mechanisms. This exclusion applies particularly to contracts in which delivery prices are expressed as a function of Exchange Value or any other independent variable. Also excluded from consideration are all data where the delivery price is defined in such a way that it cannot currently be determined.

[2] Transaction Values for 1976 through 1981 and their associated parameters (millions of pounds, number of transactions and number of months) are tabulated on pages 31 and 32 of Report 161. Corresponding data for 1982 are tabulated on page 5 of Report 173.

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*CURRENT MARKET DATA*

## CONVERSION VALUE[1] $1.40/lb. U as $UF_6$
Determined as of March 31, 1983

**Definition**

The Conversion Value is Nuexco's judgment of the price at which spot and/or near-term transactions for significant quantities of conversion services could be concluded in the secondary market as of the last day of the month.

**Derivation**

Nuexco bases the Conversion Value upon:

A. Data from recently completed transactions.
B. Data from pending transactions.
C. Firm bids to buy and firm offers to sell.
D. Prices purchasers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy, and prices sellers have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell.

**Comments**

Nuexco does not consider the following in determining the Conversion Value:

A. The price of conversion services delivered or to be delivered under old contracts.
B. The price of conversion services delivered in connection with contract renegotiations or other than arm's length transactions.

[1] Monthly data for 1981 and 1982 are tabulated on page 6 of Report 173.

## LOAN USE CHARGE RATE[2] 6%
Determined as of March 31, 1983

**Definition**

The Loan Use Charge Rate is Nuexco's judgment of the annual interest rate at which uranium loans could be concluded as of the last day of the month.

**Derivation**

Nuexco bases the Loan Use Charge Rate upon:

A. Data from recently completed or pending loan transactions.
B. Rates included in firm proposals to borrow or lend.
C. Rates that potential borrowers and lenders have expressed as a willingness to pay or accept, but for which Nuexco is not aware of firm proposals.

[2] Monthly data for 1968 through 1981 appear on pages 32-34 of Report 162. Monthly data for 1982 appear on page 2 of Report 173.

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**SWU VALUE $106/SWU for FY83**
**SWU VALUE $110/SWU for FY84**
Determined as of March 31, 1983

**Definition**

The SWU (Separative Work Unit) Value is Nuexco's judgment of the price, expressed in US dollars per SWU, at which transactions for the sale of significant quantities of SWU of any origin for delivery in the specified DOE fiscal year could be concluded as of the last day of the month.

**Derivation**

Nuexco bases the SWU Value upon:

A. Data from recently completed transactions.
B. Data from pending transactions.
C. Firm bids to buy and firm offers to sell.
D. Prices purchasers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy, and prices sellers have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell.
E. SWU prices at varying tails assays and varying product assays are converted to the equivalent SWU price at the DOE Reference Transaction Tails Assay (presently 0.20 weight percent $U_{235}$) and a product assay of three percent $U_{235}$ assuming feed costs calculated using the Nuexco Exchange Value and Nuexco Conversion Value determined as of the last day of the same month.

**Comments**

Nuexco does not consider the following in determining the SWU Value:

A. The price of SWU delivered under long-term contracts from primary suppliers, such as DOE, Urenco, or Eurodif.
B. The price of SWU delivered under other than arm's length transactions.

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*CURRENT MARKET DATA*

## EXCHANGE VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

| Country (currency) | per lb. $U_3O_8$ in Concentrates | per kg $U_3O_8$ in Concentrates | per kg U in Concentrates |
|---|---|---|---|
| Australia (dollar) | 25.68 | 56.61 | 66.76 |
| Belgium (comm. franc) | 1,070 | 2,358 | 2,781 |
| Canada (dollar) | 27.39 | 60.39 | 71.21 |
| Finland (markka) | 121.72 | 268.34 | 316.44 |
| France (franc) | 161.82 | 356.75 | 420.69 |
| FRG (mark) | 54.02 | 119.09 | 140.43 |
| Italy (lira) | 32,246 | 71,091 | 83,833 |
| Japan (yen) | 5,336 | 11,763 | 13,872 |
| Netherlands (guilder) | 60.89 | 134.24 | 158.31 |
| South Africa (rand) | 24.36 | 53.70 | 63.32 |
| Spain (peseta) | 3,048 | 6,720 | 7,924 |
| Sweden (krona) | 167.42 | 369.10 | 435.25 |
| Switzerland (franc) | 46.18 | 101.81 | 120.06 |
| UK (pound) | 15.16 | 33.41 | 39.40 |
| US (dollar) | 22.25 | 49.05 | 57.85 |

## TRANSACTION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

| Country (currency) | per lb. $U_3O_8$ in Concentrates | per kg $U_3O_8$ in Concentrates | per kg U in Concentrates |
|---|---|---|---|
| Australia (dollar) | 24.64 | 54.32 | 64.06 |
| Belgium (comm. franc) | 1,026 | 2,263 | 2,669 |
| Canada (dollar) | 26.28 | 57.94 | 68.33 |
| Finland (markka) | 116.79 | 257.49 | 303.64 |
| France (franc) | 155.27 | 342.32 | 403.67 |
| FRG (mark) | 51.83 | 114.27 | 134.75 |
| Italy (lira) | 30,942 | 68,215 | 80,442 |
| Japan (yen) | 5,120 | 11,287 | 13,311 |
| Netherlands (guilder) | 58.43 | 128.81 | 151.90 |
| South Africa (rand) | 23.37 | 51.53 | 60.76 |
| Spain (peseta) | 2,925 | 6,448 | 7,603 |
| Sweden (krona) | 160.65 | 354.17 | 417.65 |
| Switzerland (franc) | 44.31 | 97.69 | 115.20 |
| UK (pound) | 14.54 | 32.06 | 37.81 |
| US (dollar) | 21.35 | 47.07 | 55.51 |

[1] Calculated using currency exchange rates published in the Wall Street Journal on March 31, 1983.

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## CONVERSION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

| Country (currency) | per lb. U as UF₆ | per kg U as UF₆ |
|---|---|---|
| Australia (dollar) | 1.62 | 3.56 |
| Belgium (comm. franc) | 67.31 | 148.39 |
| Canada (dollar) | 1.72 | 3.80 |
| Finland (markka) | 7.66 | 16.88 |
| France (franc) | 10.18 | 22.45 |
| FRG (mark) | 3.40 | 7.49 |
| Italy (lira) | 2,029 | 4,473 |
| Japan (yen) | 335.73 | 740.16 |
| Netherlands (guilder) | 3.83 | 8.45 |
| South Africa (rand) | 1.53 | 3.38 |
| Spain (peseta) | 191.78 | 422.80 |
| Sweden (krona) | 10.53 | 23.22 |
| Switzerland (franc) | 2.91 | 6.41 |
| UK (pound) | 0.95 | 2.10 |
| US (dollar) | 1.40 | 3.09 |

## SWU VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

| Country (currency) | FY 1983 per SWU | FY 1984 per SWU |
|---|---|---|
| Australia (dollar) | 122.33 | 126.95 |
| Belgium (comm. franc) | 5,096 | 5,288 |
| Canada (dollar) | 130.49 | 135.42 |
| Finland (markka) | 579.87 | 601.75 |
| France (franc) | 770.91 | 800.00 |
| FRG (mark) | 257.34 | 267.06 |
| Italy (lira) | 52,623 | 59,420 |
| Japan (yen) | 25,420 | 26,379 |
| Netherlands (guilder) | 290.09 | 301.04 |
| South Africa (rand) | 116.04 | 120.42 |
| Spain (peseta) | 14,521 | 15,068 |
| Sweden (krona) | 797.59 | 827.69 |
| Switzerland (franc) | 220.01 | 228.31 |
| UK (pound) | 72.21 | 74.93 |
| US (dollar) | 106.00 | 110.00 |

[1] Calculated using currency exchange rates published in the Wall Street Journal on March 31, 1983.

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*CURRENT MARKET DATA*

## TRANSACTION SUMMARY[1]

### Uranium Transactions

| Nuexco Transaction Number | Delivery Period | Approximate Quantity (thousands of pounds, $U_3O_8$ equivalent) | Approximate Price as Percent of Current E.V. | Seller | Buyer | Remarks |
|---|---|---|---|---|---|---|
| 2194 | unknown | Less than 50 | unknown | Far East Entity | Far East Entity | |
| 2200 | 1984-92 | More than 6,000 | unknown | Canadian Producer | European Entity | |
| 2202 | 1983 | Less than 50 | 102 | US Producer | US Utility | |
| 2223 | 1983 | 601-1000 | 106 | Canadian Producer | European Entity | |
| 2225 | 1983 | 51-100 | 100 | unknown | US Producer | |
| 2226 | 1983 | Less than 50 | 106 | US Producer | US Producer | |
| 2242 | 1983 | 51-100 | Less than 98 | US Producer | US Utility | Price related to market<br>Not arms length |

### Conversion Transactions

| Nuexco Transaction Number | Delivery Period | Approximate Quantity (thousands of pounds, U equivalent) | Approximate Price as Percent of Current C.V. | Seller | Buyer | Remarks |
|---|---|---|---|---|---|---|
| 2245 | 1983 | 101-300 | Less than 100 | US Entity | US Utility | |

### Loan Transactions

| Nuexco Transaction Number | Delivery Period | Approximate Quantity (thousands of pounds, $U_3O_8$ equivalent) | Approximate Price as Percent of Current L.U.C.R. | Lender | Borrower | Remarks |
|---|---|---|---|---|---|---|

There are no loan transactions reported this month.

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[1] Transactions listed are not limited to those in which Nuexco was involved, but also include others of which Nuexco is aware.

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## URANIUM SUPPLY
(As of 3/31/83)

| Nuexco Project Number | Delivery Period[1] (Thousands of Pounds $U_3O_8$) Within 1 Year | Beyond 1 Year | Remarks |
|---|---|---|---|
| **Available for Sale:** | | | |
| **ACTIVE** | | | |
| 1575 | | 500 per year | Long Term |
| 1818 | | 300 per year | Long Term |
| 1921 | 2,100 | | $UF_6$ |
| 2017 | | 2,300 | |
| 2038 | 2,000 | | $UF_6$ |
| 2056 | 2,200 | | $UF_6$ |
| 2203 | 1,200 | | |
| TOTAL: | 7,500 | | |
| **INACTIVE** | | | |
| 1928 | 1,000 | | $UF_6$ |
| 2134 | | 300 per year | Long Term |
| 2196 | 500 | | |
| TOTAL: | 1,500 | | |

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[1] Measured from the date of this Report

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*CURRENT MARKET DATA*

## URANIUM DEMAND
(As of 3/31/83)

| Nuexco Project Number | Delivery Period[1] (Thousands of Pounds $U_3O_8$) |  | Remarks |
|---|---|---|---|
|  | Within 1 Year | Beyond 1 Year |  |
| **Inquiries to Purchase:** |  |  |  |
| **ACTIVE** |  |  |  |
| 1871 |  | 250 per year | 1984-86 |
| 1996 | 400 |  |  |
| 2010 |  | 400 per year | 1984-92 |
| 2030 |  | 1,000 | 1984-85 |
| 2042 |  | 400 per year | Long Term |
| 2061 | 25 |  |  |
| 2115 | 200 | 200 |  |
| 2123 | 500 | 500 per year | 1983-87 |
| 2152 |  | 750 per year | Long Term |
| 2163 |  | 400 per year | $U_3O_8$ or $UF_6$ |
| 2167 | 250 | 250 + per year | 1984-99 |
| 2187 | 100 |  |  |
| 2217 | 900 | 500 per year | 1984-95 |
| 2238 | 50 |  | Enriched $UF_6$ |
| 2269 | 250 |  |  |
| 2270 | 175 |  |  |
| TOTAL: | 2,850 |  |  |
| **INACTIVE** |  |  |  |
| 1459 |  | 200 per year | Long Term |
| 1843 | 250 |  |  |
| 1888 |  | 400 per year | Long Term |
| 1999 |  | 50 per year | 1985-90 |
| 2025 |  | 350 |  |
| TOTAL: | 250 |  |  |

[1] Measured from the date of this Report.

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## CONVERSION SUPPLY
### (As of 3/31/83)

| Nuexco Project Number | Delivery Period[1] (Thousands of Pounds U as $UF_6$) Within 1 Year | Beyond 1 Year | Remarks |
|---|---|---|---|
| **ACTIVE** | | | |
| 1609 | 500 | 1,500 per year | Long Term |
| 1840 | 130 | | |
| 1936 | 1,000 | 200 per year | Long Term |
| 2051 | 1,000 | | |
| 2143 | 400 | | |
| TOTAL: | 3,030 | | |
| **INACTIVE** | | | |
| 2008 | 800 | 800 | |
| 2181 | 650 | 650 per year | Long Term |
| TOTAL: | 1,450 | | |

## CONVERSION DEMAND
### (As of 3/31/83)

| Nuexco Project Number | Delivery Period[1] (Thousands of Pounds U as $UF_6$) Within 1 Year | Beyond 1 Year | Remarks |
|---|---|---|---|
| **ACTIVE** | | | |
| 2129 | 500 | 500 | |
| 2135 | 135 | 135 per year | 1984-87 |
| 2148 | | 400 per year | 1984-90 |
| 2190 | 100 | 100 per year | Long Term |
| TOTAL: | 735 | | |
| **INACTIVE** | None | | |

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[1] Measured from the date of this Report.

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*CURRENT MARKET DATA*

## LOAN SUPPLY AND DEMAND
### (As of 3/31/83)

| Nuexco Project Number | Delivery Period[1] (Thousands of Pounds $U_3O_8$) Within 1 Year | Beyond 1 Year | Remarks |
|---|---|---|---|
| **Available for Loan:** | | | |
| **ACTIVE** | | | |
| 1938 | 1,500 | | |
| 2121 | 600 | | |
| 2128 | 2,500 | | |
| 2204 | 500 | 200 per year | Long Term |
| TOTAL: | 5,100 | | |
| **INACTIVE** | | | |
| 1815 | 1,000 | | $UF_6$ |
| 1884 | 600 | | |
| 1910 | 1,000 | | |
| 1931 | 600 | | |
| 2036 | 500 | | $UF_6$ |
| 2040 | 600 | | $UF_6$ |
| 2133 | 200 | | |
| 2139 | 2,000 | | |
| 2157 | 600 | | |
| TOTAL: | 7,100 | | |
| **Inquiries to Borrow:** | | | |
| **ACTIVE** | | | |
| 1998 | 200 | 200 | |
| 2006 | 600 | | |
| 2070 | 200 | | $UF_6$ |
| TOTAL: | 1,000 | | |
| **INACTIVE** | None | | |

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[1] Measured from the date of this Report

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## AFRICA

**Niger**'s uranium sales during 1982 are summarized in Table 1.

**Table 1**

**NIGER URANIUM SALES IN 1982**
**(Thousands of Pounds $U_3O_8$)**

| **Buyer** | **Seller** |
|---|---|
| France | 6,601 |
| Germany, Federal Republic | 325 |
| Italy | 325 |
| Japan | 2,702 |
| Netherlands | 260 |
| Spain | 520 |
| TOTAL | 10,733 |

### South Africa

Public statements released in recent months by senior mining house officials in South Africa are noteworthy in several respects.

1. They have been consistent in their expectation that their earnings pictures are not likely to improve substantially for some time.

2. They have revealed a sensitivity to the impact spot prices have had on the "market" prices negotiated under their long-term contracts.

3. As information on uranium matters is tightly controlled in South Africa, the fact that these views have been expressed publicly implies that they reflect some degree of consensus regarding future market behavior.

Some highlights are presented below:

1. In a review of the uranium market released March 30, Messrs. G. Langton and D.A. Etheridge, senior officials of Anglo-American and chairmen of Western Deep Levels and Vaal Reefs, respectively, commented as follows:

"Uranium prices on the spot market resumed their falling trend at the beginning of the year and by August had reached their lowest level since 1975. Prices have since recovered somewhat, although they remain beneath those ruling at the start of 1982.

"A decline was halted, initially, by prospects of legislation in the US that would have limited imports of uranium. In the event, the legislation was not enacted. Taken with decreased liquidation of surplus utility inventories, as interest rates and carrying costs fell, near-term market sentiment altered. As a result, certain consumers started to buy material for inventory in the expectation of substantial price increases in the longer term. As prices rise, such purchases may be expected to fall away. There remains, nevertheless, a substantial imbalance between supply and demand and, in spite of projections of declining inventory levels relative to consumption, the quantities of uranium overhanging the market suggest that the situation is unlikely to improve significantly for some time.

"While prices negotiated with our customers in terms of long-term contractual sales have not declined to the same extent as spot prices, we see little likelihood of an improvement in our revenues in the immediate future."

2. The chairman of Randfontein and Western Areas, Mr. G. Y. Nisbet, commented as follows:

"The uranium price decline, which began in 1979, continued during 1982. The lowest uranium spot price as published by Nuexco in 1982 was $17.00 per pound in September and October of that year, compared with a price of $23.50 in December, 1981. This reduction in the spot price has been a reflection of a basic imbalance between demand and supply following a worldwide reduction in energy consumption. In the absence of significant decreases in uranium production, stocks continued to increase substantially. Sales from stock by American utilities committed to purchase quantities of material substantially in excess of their requirements and the sale of uncommitted production by certain North American producers exacerbated the decline in the uranium price.

"Fortunately, however, most major consumers with long-term contracts for their requirements have taken a realistic view of the decline in the uranium price in order to ensure continuity of supply. As a result, the price associated with such contracts has, in many instances, not been as severely affected as it might otherwise have been. In addition, the lower rand/dollar exchange rate that prevailed during most of 1982 offset, to some extent, the lower dollar price.

"Towards the end of 1982 the Nuexco uranium spot price increased to $19.75 per pound. Although this may suggest that the decline in the market has been arrested, the industry is still faced with the fact that production will probably exceed demand for some time to come, particularly while regulatory constraints and concerns

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about environmental issues influence the construction of further nuclear power facilities in the United States and other industrialized countries. However, the force of these considerations should diminish if any significant upturn occurs in the demand for electric power."

3. The chairman of Anglo American Gold Investment Company, Ltd. (Amgold), Mr. J. Ogilvie Thompson, commented as follows:

"Although spot uranium prices declined further during the year, they now show a significant improvement on the lowest prices, reached early in the second half of 1982. The turning point came when it seemed that legislation to restrict imports of uranium into the US was imminent. At the same time, a fall in US interest rates, and hence carrying costs on inventory, lessened the rate and volume of offers of surplus inventory for sale by electric utilities. The consequent improvement in short-term market sentiment has had some impact on longer-term price expectations. As a result, certain consumers began to buy additional material at what they considered bargain prices, even allowing for the cost of financing stocks for several years. At higher spot prices, this off-take has in large part fallen away.

"The spot market, however, represents only a very small proportion of international uranium trading and there remains a considerable surplus of material, in spite of the probable deferment of some projects still in the planning stage and of substantial cuts in production. These have been mainly in the US, but there have also been reductions in other countries including South Africa, where production fell to 6,877 tons in 1982 from 7,001 tons in 1981. Although utility inventory levels relative to consumption are likely to fall, the fact that negotiated prices under long-term contractual arrangement have not declined to the same extent as spot prices suggests that this market will not see any significant improvement for some time to come."

## AUSTRALIA

Under the leadership of Mr. Robert James Lee Hawke, the Australian Labor Party (ALP) won a decisive victory in the Australian general elections on March 5, 1983. On March 8, the first Hawke Cabinet was selected consisting of 27 members. The fact that only three identify themselves with the extreme left constitutes an overwhelming triumph for the ALP moderates.

In a break with Labor Party tradition, Mr. Hawke appointed an inner cabinet of 13 senior ministers who will act as the primary decision-making body. This move has enabled Hawke to consolidate his power and to depend less upon the Labor Party caucus. The inner cabinet is made up of pragmatists who understand the importance of balanced government and the need to build solid bridges with the business community. Both the Treasurer and the Minister for Trade are also known for their support of minimum government interference with the marketplace.

Mr. Stewart West, who administers the portfolio of Immigration and Ethnic Affairs, is the only member of the inner cabinet who is of the extreme left.

The new Minister for Resources and Energy, Senator Peter Walsh of Western Australia, has been known for his tough, no-holds-barred style of politics. The former wheat farmer who entered Parliament in 1974 has been the opposition spokesman on primary industry, finance, trade and national development as well as resources. His attitude towards uranium is likely to be shaped by the party's collective interpretation of the role Labor Party policy must play in uranium activities.

It is premature to make an assessment of the Labor Party's uranium policy. However, the prevailing attitude is one of cautious optimism as more than half of the inner cabinet members seem to hold pro-uranium views.

The Atomic Energy Act, which regulates the ownership of uranium in the Northern Territory, will be administered by the Minister for Resources and Energy (Peter Walsh). As the Minister for Trade (Nigel Bowen) controls uranium export policy, the new government will continue with the traditional split of responsibility between domestic development and export. Because all uranium resources are owned by the states until mining rights are granted to a developer (except those resources found in the Northern Territory), the Minister for Resources and Energy has limited influence in uranium matters except as they relate to the Northern Territory.

Overall, Mr. Hawke has chosen a cabinet which will focus on efficiency and aim for effective economic management. The overall level of capability within his cabinet, coupled with the absence of militant social reformers, is a strong indication of the contrast between the Hawke administration and the Whitlam era of 1973-1975.

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At present, plans for the administration of uranium matters, especially regarding exports, are still under consideration. The AUEO (Australian Uranium Export Office) will stay in the Trade Department. While the new Minister for Trade (Nigel Bowen) has been briefed on the contract approval system, new export permits under existing contracts of Energy Resources of Australia, Ltd. and Queensland Mines, Ltd. will not be needed in the near future, so, therefore, will not call for immediate action or implementation.

In Australia, uranium marketing takes place under ministerial determinations. While these determinations remain in force, prospective producers are entitled to pursue market opportunities. If the new government does not change this system, it will tacitly consent to uranium sales from new projects. Direct intervention, in the form of a cancellation of these determinations, would be seen by the market as a signal for great caution. This particular issue is expected to trigger discussions between uranium producers and the new government — discussions the uranium industry would most likely not press for at such an early stage of policy development. The industry's perception is that it would be more advantageous to allow the government to grapple with issues of higher priority before calling for the establishment of universal uranium policy.

Australia's economic conditions leave the government little choice other than to continue with the development of projects and exports. However, if the government wishes to give the appearance of leaving the future of new mines to the market, it need only retain the old price guidelines. If taken at face value, they would make it impossible to obtain new contracts for a considerable period.

* * *

The UEGA (Uranium Enrichment Group of Australia) will probably proceed quietly with their market study, anticipating that the government's involvement will not become relevant until UEGA decides to proceed with their full feasibility study. At that time they would require that the government be involved in the tripartite safeguards agreements between the Urenco countries and Australia.

* * *

The South Australian government has indefinitely deferred the two in-situ leach uranium projects, Honeymoon and Beverley. The state Minister for Mines and Energy justified the decision on the basis of the ALP's federal uranium policy platform and upon environmental grounds. The government believes it to be better policy to promote the large Olympic Dam copper uranium development now undergoing feasibility testing than to promote two smaller mines. In the near term the government is constrained by an ambivalent ALP uranium policy which allows existing producers to continue operations but makes room for the Olympic Dam development. Under this policy it seems that one may interpret that there may be enough flexibility to allow for both an expansion of ERA's Ranger project and the sale of Queensland Mines surplus production to absorb whatever contracts may come to Australia before the Olympic Dam project can be marketed. Although other Australian projects might potentially be able to demonstrate their feasibility by obtaining sufficient uranium contracts to baseload their plants at acceptable prices, the government is not convinced that this will occur in the next two years. However, the next ALP federal convention in 18 months may offer the government the opportunity to free uranium policy from the more restrictive clauses.

Within the constraints imposed by the realities of the uranium market and the limitations set by the present party platform, the ALP government's uranium development objectives will probably leave the operating projects largely undisturbed. Negative as it may seem at present, the weakness of the uranium market may have also some saving effects: For the government, it bridges the period to the next ALP convention, where a less ambivalent policy could emerge without the need to make discouraging decisions in the meantime. Therefore, the industry seems sheltered for the moment from drastic phase-out decisions which could affect projects still in the planning stage, barring the two exceptions in South Australia. However, the selective support shown by the government has left most, if not all, other uranium projects in a questionable position. Furthermore, uncertainty regarding the government's policy could erode international market confidence. On the other hand, unless the market responds more favorably to the Australian producers' on-going sales efforts, their planned development timetables could be set back considerably.

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*RECENT DEVELOPMENTS*

## EUROPE

### Belgium

In Report 174, Nuexco mentioned that Belgium's decision on whether to purchase a 20 to 25 percent share in two 1300 MWe plants France would build at Chooz depends on a determination of the nation's energy policy. That decision has been postponed even further, largely due to disagreements between the Flemish and Walloon segments of the population.

### France

France and India have finally signed the agreement on the supply of nuclear fuel for the US-built nuclear power plant at Tarapur, in Maharashtra State near Bombay. The first delivery of enriched uranium will be sent in the next two or three months to the Indian fabrication plant at Hyderabad. The London Club's agreed safeguards stipulations on the enriched uranium will only apply until 1993, but bilateral talks are expected to start soon to agree to additional safeguards which would be enforced after that date.

* * *

France and Pakistan have begun talks on the supply by Framatome of a 900 MWe PWR which Pakistan wants to build at Chashma, 150 miles southwest of Islamabad. Financing will be a major obstacle for the plant. The other problem is one of safeguards. While the plant itself will be subject to IAEA safeguards, M. Cheysson, the French Foreign Minister, has admitted that France will not be following the London Club's safeguards agreement which necessitates that all nuclear installations be placed under international control. This issue of full-scope safeguards is one which is becoming increasingly controversial for France.

* * *

The Superphenix fast breeder reactor (FBR) is approximately 80 percent complete and present plans call for it to be connected to the grid in mid-1984. The Phenix FBR commercial demonstration project, which was shut down on February 15, is now operating at two-thirds of its nominal capacity of 250 MWe. The shutdown was brought about by a leak in the third steam generator. Three other similar incidents have taken place due to the wear of non-nuclear parts after nine years of operation.

* * *

Electricité de France (EdF) has obtained authorization to build the first unit of its nuclear power plant at Golfech in the Tarn and Garonne (near Toulouse). This unit will be a 1300 MWe PWR, the first of four such units EdF would like to build on the site. The project was one of those most disputed by ecologists and was "frozen," then "unfrozen" by the Socialist government of M. Mitterand.

On February 26, EdF received official authorization for construction of the first unit of the plant to be built at Penly, east of Dieppe. It is scheduled to enter into service in 1989.

EdF presently plans to connect Blayais Unit 3 to the grid by the end of April. Blayais Unit 4 is to follow two months later. Both units are 900 MWe PWRs.

* * *

### Spain

Spain's Socialist government favors reducing the nation's nuclear power program to an installed nuclear capacity of 7,500 MWe by 1990 rather than the 11,500 MWe by 1987 which the previous government had been aiming for. Six units, aggregating approximately 5,900 MWe, are vulnerable to cancellation or delays:

1. Trillo Units 1 and 2 — 1,000 MWe PWRs scheduled for operation in 1985 and 1987, respectively;
2. Valdecaballeros Units 1 and 2 — 975 MWe BWRs scheduled for operation in 1986 and 1988, respectively;
3. Vandellos Unit 2 — 960 MWe PWR scheduled for operation in 1987;
4. Sayago — 1,000 MWe PWR which might have been built at Sayago.

Sr. Alfonso Alvarez Miranda, President of the Spanish Atomic Forum, has indicated to the government that this action would increase unemployment and hinder the country's industrial growth. It has been estimated that about 20,000 people would have to be laid off in the nuclear industry. Such a course of action would run counter to the Socialists' promise to create 800,000 new jobs in the next four years. If the plants under construction were not completed, about 225 billion pesetas would be lost. The Socialist government has declared that conversion of the threatened plants to coal would make the loss of investment minimal, so the prime issue would be the preservation of jobs.

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## United Kingdom

The signing by British Nuclear Fuels, Ltd. (BNFL) of a major contract for the supply of fuel for the British nuclear submarine fleet will require the construction of another gas centrifuge enrichment plant at Capenhurst, England. Construction is scheduled to take four years at a cost of approximately 100 million pounds. Present plans call for the new Capenhurst plant to enrich the fuel to an intermediate level and for the remainder of enrichment (to higher levels) to be carried out elsewhere.

The trade press has reported that BNFL is about to sign contract(s) for the purchase of "a few hundred tonnes" of uranium on the spot market, essentially to supply the working inventory for the newly commissioned enrichment plant. The purchase will also serve as a buffer stockpile and increase the flexibility of plant operations.

## JAPAN

Initial results of annual price negotiations between Japanese utilities and their major suppliers of uranium under long-term contracts appear to indicate that the downward price trend of recent years is continuing. During March, a group of Japanese utilities agreed to pay approximately $33 to $34 for 1984 deliveries from African suppliers. After paying approximately $45 per pound $U_3O_8$ for 1981 deliveries, Japanese utilities negotiated price reductions of $5 to $7, so that 1982 prices were in the range of $37 to $38.50. Agreed prices for 1983 were approximately $35.50, a reduction of $1.50 to $3.

The agreed prices for 1984 represent further reductions of approximately $1.50 to $2.50. Just three months ago, it appeared likely that the Japanese utilities would demand, and receive, reductions of $5 to $10 per pound. However, the spot/near-term market price recovery of recent months has somewhat mitigated the disparity between spot/near-term prices and long-term prices, so as to reduce the pressure for larger price reductions. Expectations of continuing spot/near-term price increases, combined with the Japanese utilities' desire to maintain good relations with long-term suppliers may also have played a part.

## UNITED STATES

### EDITED LUNCHEON REMARKS OF GEORGE WHITE, JR.

**Kansas City**
**March 21, 1983**

Nuexco was founded in 1968 by Payne Kibbe and George White, Sr. Bob Wolcott, Nuexco's current Chairman and C.E.O. has been associated with the firm since that time, as a founding Director and President. We currently employ a total of 28 people in 4 offices: Menlo Park, California; Stamford, Connecticut; Ferney Voltaire, France; and Atlanta, Georgia. In addition, we have a network of 12 representatives and special consultants in the United States and overseas in various uranium producing and uranium consuming areas.

Our business activities fall into three main areas:

1. We are publishers — most of you are familiar with the Monthly Report.
2. We are consultants — we develop analyses and studies on supply and demand, prices, procurement and marketing strategies and assorted other topics. We work on both a custom and multi-client basis.
3. Finally, we are brokers of fuel cycle materials and services. We are not traders. We do *not* take principal positions for our own risk and account. Similarly, our standard fees are related to quantities of material transacted and not the price of the transaction. From a business standpoint, we are indifferent to price.

I would now like to share some thoughts about the nuclear fuel market.

1. The nuclear fuel market is currently characterized by excessive productive capacity and excess inventory. The fact of the matter is that our ability to produce uranium, conversion and SWU far exceeds our current and even longer-term utilization rates. Excess capacity and idle capital investment are bad enough, but even worse, production continues in excess of consumption, and inventories continue to increase.

The development of enormous excess inventories exerts, in turn, enormous financial strain on the inventory holders, which in turn leads to inventory liquidation. Such liquidation, as we have seen, has led to a collapse of uranium spot prices and the development of severely discounted markets for conversion and enrichment services. One is inescapably led to the conclusion that prices will be weak, and buyers will dominate the market until the inventory liquidation is complete.

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*RECENT DEVELOPMENTS*

A second conclusion is that production rates must and will, in time, be more nearly rationalized with consumption rates. We have seen the beginning of this rationalization. The bold plans to produce more uranium, more conversion and more SWU ran head first into the reality that there simply weren't enough buyers. Quite correctly, most of these plans have been cancelled or deferred.

2. The nuclear fuel market will be characterized by an unending series of boom-bust cycles. My reasoning is based on the fundamental nature of the utility charter; namely, reliable service at the lowest possible rates consistent with a regulated rate of return sufficient to attract investment capital. If only five words could be used to describe utility business philosophy, I would choose the words "conscious policy of risk aversion." This is not intended to be critical of utilities, but merely a statement of the way things are and must be. I personally prefer cheap electricity. However, I prefer expensive electricity to no electricity at all.

Risk aversion translates into policies of conservatism. Too much, too soon may not be desirable, but it certainly beats too little or too late. Too much, too soon dictates excess productive capacity, be it in uranium, conversion or enrichment. Excess capacity and inventory build-up lead to price weakness. Price weakness is followed by a diminution of new capital investment, then later by utility concerns of future shortages, then later by higher prices, etc.

It has been said that those who don't learn from history are bound to repeat it. In this case, however, the utilities cannot be blamed. It is a condition of their existence.

As you are aware, uranium is a unique commodity. It has but one use. It is, so far as buyers are concerned, totally price inelastic. There will *never* be a real demand-pull situation in uranium. The best that sellers can ever hope for is a perception of future shortage, to drive up prices. Classic economic theory must be recalibrated to take account of both the unique nature of uranium as well as the unique nature of its user group.

3. The nuclear fuel market has become a truly international one. US uranium is flowing to Europe, Taiwan, Korea and Japan. Canada, South Africa, Australia, Namibia and Niger also ship to customers around the world. US utilities contract for conversion in Canada and Europe as well as the US. Europeans, Japanese, Taiwanese, Koreans and others buy conversion in the US, France, Canada, and the UK. The development of the secondary conversion market has added to this mix.

In the enrichment area, the monopolistic position of DOE is a thing of the past. Eurodif, Urenco, and the USSR have captured significant market share. Assignments and sales of SWU in the secondary market have become an enormous business, crossing international boundaries with ease.

It is now a world market. Embargos and cartels, government sponsored or otherwise, designed to regulate commerce are doomed to fail, as are legislative attempts made in the name of non-proliferation. The efforts of the US government in this area are the clearest demonstration of just how counter-productive such efforts can be. The dominant US enrichment position has been lost; the US is no longer viewed as a credible supplier. South Africa, Brazil and others are moving as rapidly as possible to create indigenous enrichment capacity. That's not what I would call a very effective non-proliferation policy.

In the commercial area, Australia's uranium floor price policy gave Canada a once-in-a-lifetime opportunity to sweep the market for two years. My thought here is very simple — if I may borrow a term from my Wall Street past, "Don't fight the tape — you'll get killed."

Finally, I would observe that the previous comments suggest a very complex market in which the financial stakes are enormous. Four hundred million pounds of excess $U_3O_8$ at $25 per pound represent a capital investment of $10 billion. At 15 percent, the carrying cost alone is $1.5 billion annually. If conversion and SWU are added, we are talking of waste, in our relatively small industry, of more than $3 billion annually.

Consider a European seller of enriched product which is physically located in Europe. Before the transaction is fully concluded, it may involve a Japanese buying SWU through a de-enrichment swap, followed by a US utility purchasing the conversion component via a location and de-conversion swap, followed by Canadian producer purchasing the $U_3O_8$, after a nationality swap, for delivery at US converter to a European buyer. This is not a flight of fancy. Such transactions do occur. These are complicated deals requiring technical skills, commercial savvy, regulatory knowledge, timing and a fair measure of good luck.

In conclusion, I would note my view that the market will not settle down. Rather, it is going to be more volatile, more complex, and more expensive.

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## THE ARIZONA STRIP

### Introduction

Exploration for uranium throughout the Arizona Strip country and the south bank of the Colorado River continues almost unabated. Even though there are fewer companies exploring than reported one year ago by Nuexco (Report 163, March 1982), the district is perhaps the most active in the world today for uranium exploration. At least six companies are competing for exploration and mining rights to uranium as it occurs in breccia pipes — circular, chimney-like masses of highly fragmented rock found within the extensive drainage system of the Grand Canyon region. The acreage controlled by the active companies is situated in the northern portion of Mohave and Coconino Counties, Arizona. Total acreage has increased from about 600 thousand acres last year to well over one million acres today. The area of interest has only recently expanded northward into Utah.

Present exploration activities primarily consist of prospecting for surface evidence of pipe structures, usually along canyon rims, and follow-up staking of mining lode claims over favorable structures. After a pipe has been located, detailed geologic, geochemical and geophysical studies are made to determine priorities for drilling the pipe. However, due to competition for exploration targets, drilling is secondary to gaining a land position as illustrated by the fact that acreage claimed or leased during 1982 was almost double that of 1981; drilling was limited to less than 300,000 feet in 1982.

Mining activity is currently limited to two pipes. The Hack 1 and 2 mines, located in Hack Canyon, are being mined at a combined daily rate of 800 to 1000 tons of ore per day. All ore is currently being stockpiled at the respective mines. A third pipe is currently in the final stages of mine development, and mining permits are pending on yet a fourth pipe. Several more pipes are in the final phase of exploration, but the majority of known pipes remain to be adequately explored.

### Structural Analysis of Breccia Pipes

The formation of breccia pipes in the Grand Canyon district is considered to be directly related to the simultaneous occurrence of regional structural events and erosion by the Colorado River drainage system. Pronounced structural changes began to occur in early Paleocene time (Tertiary age) when the Kaibab uplift formed a broad dome throughout the Grand Canyon region. Major north-south trending faults and anticlinal and synclinal folding resulted from continued uplifting of the dome. A combination of the domal uplift and rapid erosion by the Colorado River created the Grand Canyon Gorge. The river and its major tributaries were in the present channel system by early Miocene time. As stream erosion cut lower, especially through the massive Redwall Limestone of Mississippian age, dramatic changes occurred in regional geohydrology. The permanent loss of natural hydrostatic pressure allowed rapid downward migration of aqueous solutions through all geologic strata, and large caverns were created in the Redwall Limestone. The caverns represent the initial development of a breccia pipe structure.

Continued solution activity gradually enlarged the dimensions of the caverns, especially vertically, to the extent that large rock segments from overlying formations began to subside into the cavity area. As the subsidence continued upward into the younger formations, a chimney-like structure formed. (In this context, a breccia pipe differs from a diatreme, which is a breccia-filled volcanic pipe formed by a gaseous explosion.) A continued and prolonged subsidence pattern resulted in fragmentation of "brecciation" of the downdropped rock segments. Concentric fracturing and faulting, referred to an annular rings, are common around the outer edge of the pipe as a component of rock stress created by erosion and subsidence. The structural features extend from the Redwall Limestone upward into the Kaibab Limestone and, in certain areas, into the overlying Moenkopi Formation. Breccia pipe structures may vary from about ten meters to 300 plus meters in diameter and are recognized on the surface by layers of tilted and broken rock. Such surface expressions of pipe structures are the much sought after targets for exploration groups. Figure 1 illustrates a breccia pipe in structural relationship with the sedimentary sequence in the Grand Canyon region.

Uranium mineralization was introduced into breccia pipe structures during late stages of solution migration (Miocene and Pliocene times). The probable source of the mineral-rich solutions was the massive sandstone and limestone formations of Permian age. Continuous fluctions of solution flow resulted in intense rock alternation and remobilization of minerals, primarily within the core of the pipe. A trace of mineralization was deposited in all formations influenced by pipe development; however, known high-grade uranium minerali-

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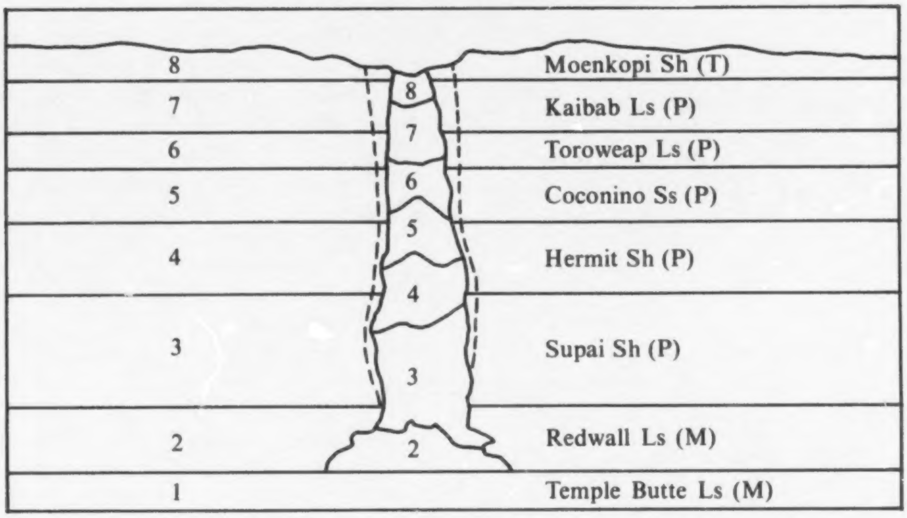
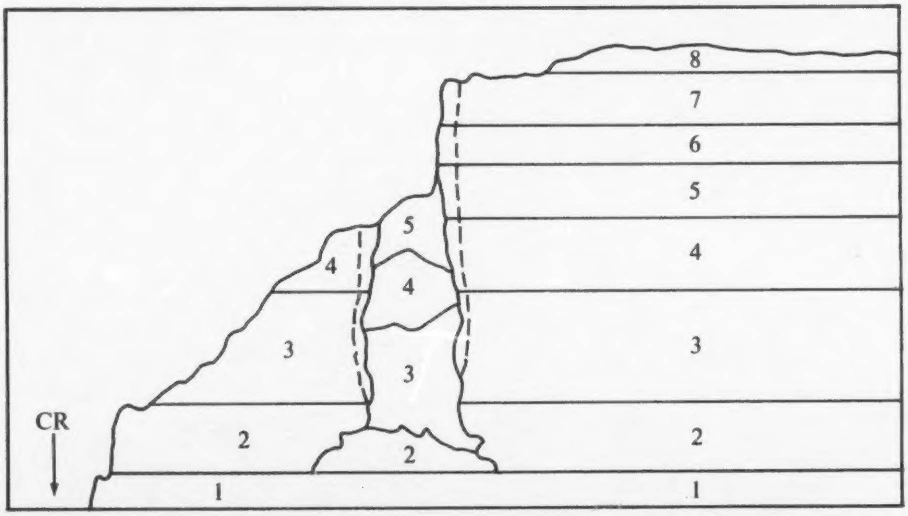
## Figure 1

## TYPICAL BRECCIA PIPE


8
7
6
5
4
3
2
1
Moenkopi Sh (T)
Kaibab Ls (P)
Toroweap Ls (P)
Coconino Ss (P)
Hermit Sh (P)
Supai Sh (P)
Redwall Ls (M)
Temple Butte Ls (M)

**A. Vertical section of breccia pipe showing how subsidence might have occurred.**


CR
8
7
6
5
4
3
2
1

**B. Eroded section of breccia pipe in canyon rim similar to Orphan Lode and Hack 1 and 2 mines. Irregular subsidence pattern causes brecciation. Uranium occurs in Units 3 and 4.**

### LEGEND

| | |
|---|---|
| Ls — Limestone | M — Mississippian age |
| Sh — Shale | P — Permian age |
| Ss — Sandstone | T — Triassic age |
| CR — Colorado River gorge | Dashed lines — Annular ring faults |

Formations numbered to illustrate magnitude of subsidence.

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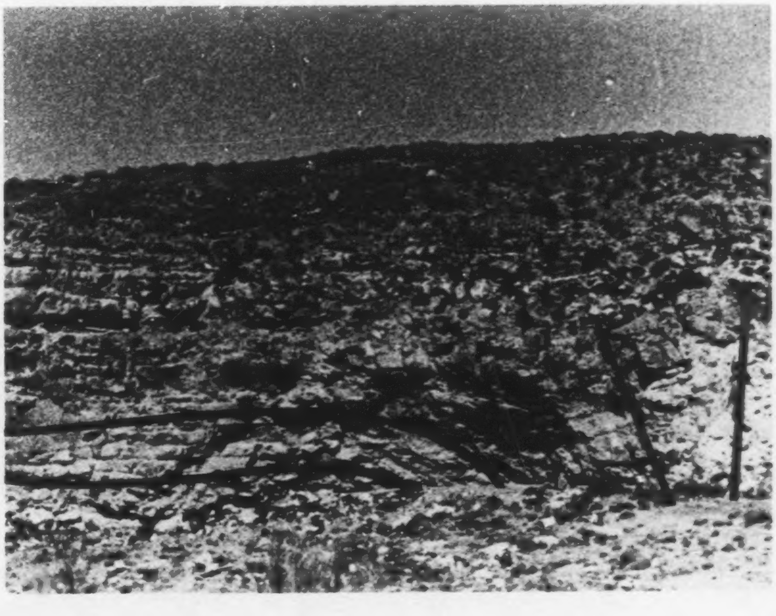
zation is thus far limited to the annular ring and brecciated segments of the Supai and Hermit formations. Uraninite and coffinite are the important uranium minerals present; torbernite and metatorbernite are the most common secondary minerals present.

Figures 2 through 8 show several important structural features associated with breccia pipes. Taken separately or in combination, the features represent useful geologic guides to prospecting for breccia pipes:

**Figure 2**

**PIPE 1 — Apparent edge of a pipe structure as formed in the Kaibib Limestone. The near vertical lines on the right are faults and may represent at least two annular ring structures. The horizontal rock layers dipping downward indicate subsidence into the pipe. Estimated diameter of pipe is about 80 meters.**



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*RAW MATERIALS*

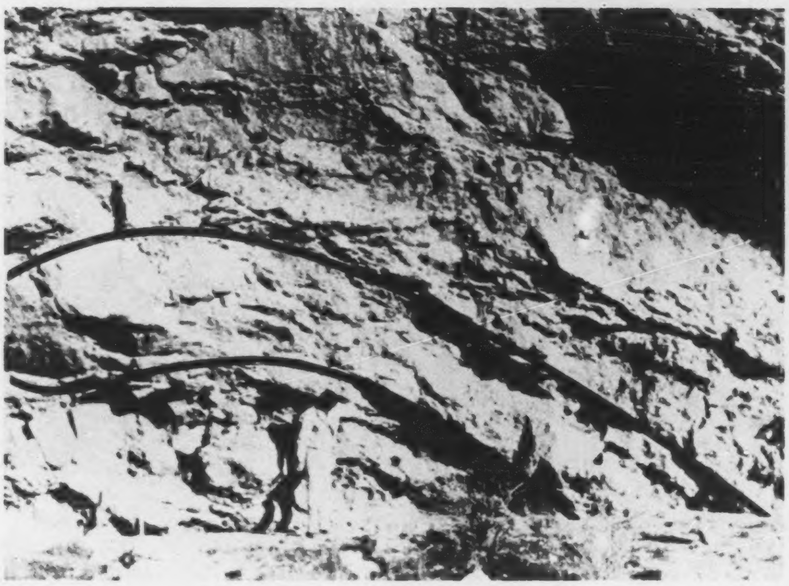

Figure 3

**PIPE 1 — View of limestone layers dipping into the pipe, taken from distance of about 12 meters.**

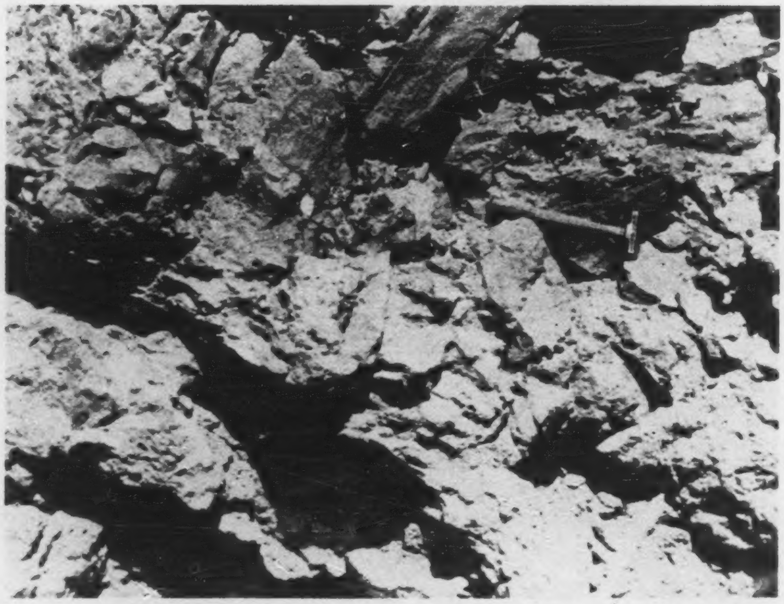

Figure 4

**PIPE 1 — Close-up view of brecciated limestone. Picture position about middle portion of dipping beds of Figure 3. Scale illustrated by hand sledge.**

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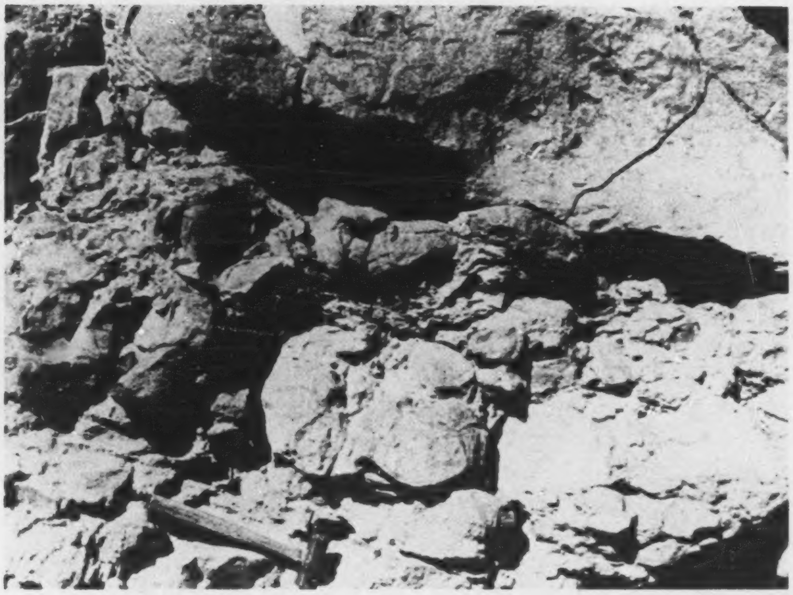

Figure 5

**PIPE 1 — Close-up view of brecciated limestone. Picture position about 8 meters left of Figure 4. Note brecciation is less intense.**

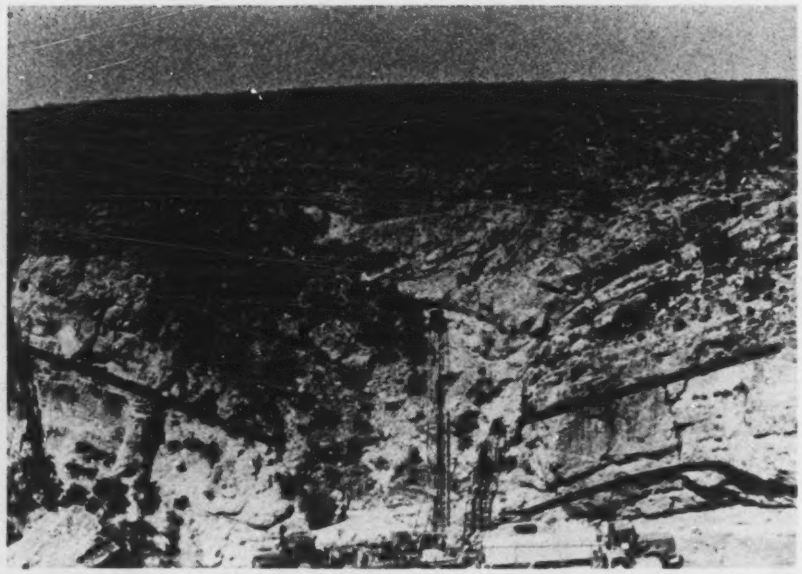

Figure 6

**PIPE 2 — Erosional edge of top of pipe in Kaibab Limestone. Note subsidence of massive limestone toward center of pipe structure. Near vertical faults on left may be annular ring structures. Pipe diameter is about 35 meters. Drill rig is situated near center of structure.**

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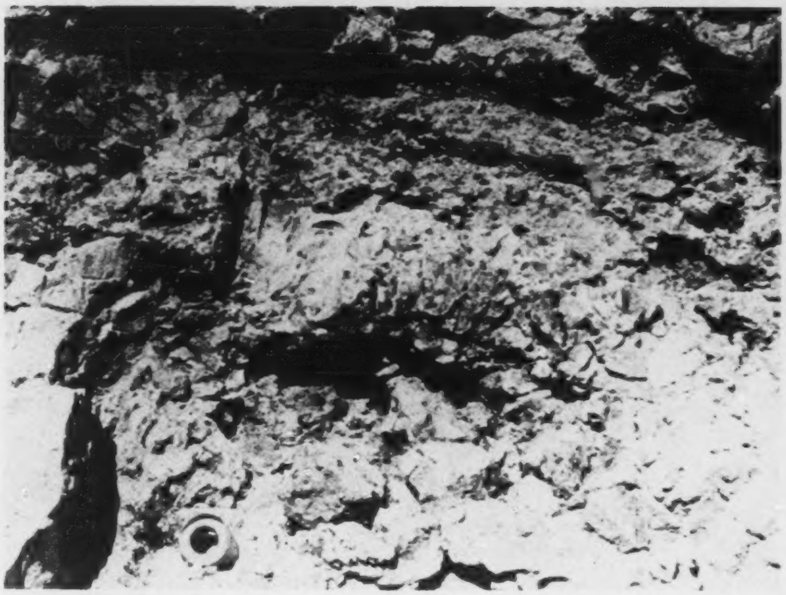

**Figure 7**

**PIPE 2 — Close-up of brecciated limestone. Note small size of limestone fragments compared to roll of tape at lower left. Brecciation is more intense than in Pipe 1, probably due to the closer relationship to the center of the pipe structure.**

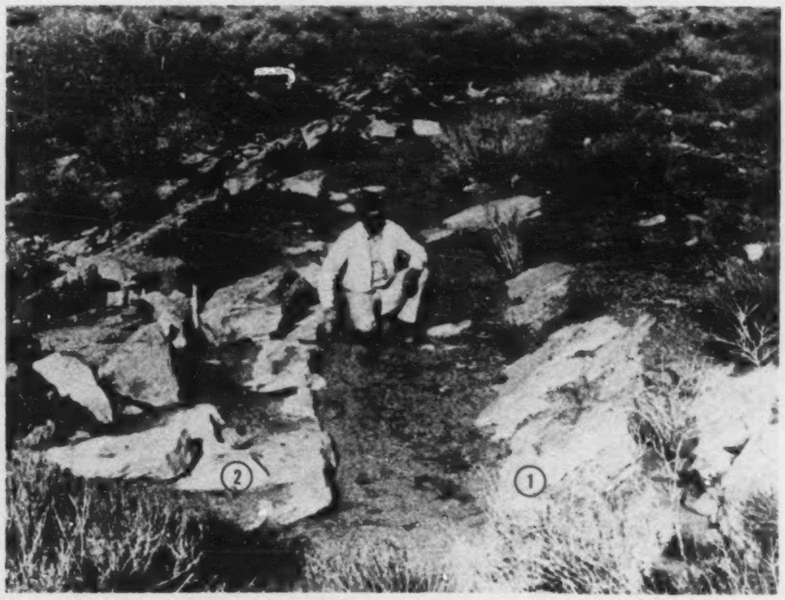

**Figure 8**

**PIPE 3 — Note that all beds are dipping to the left. Bed 1 is Kaibab Limestone of Permian age; bed 2 is the overlying Moenkopi Formation of Triassic age. The Moenkopi is an erosional remnant filling a structural depression formed in the Kaibab Limestone. The dipping beds can be traced on surface to form a circular structure about 360 meters in diameter, making it one of the largest structures in the district.**

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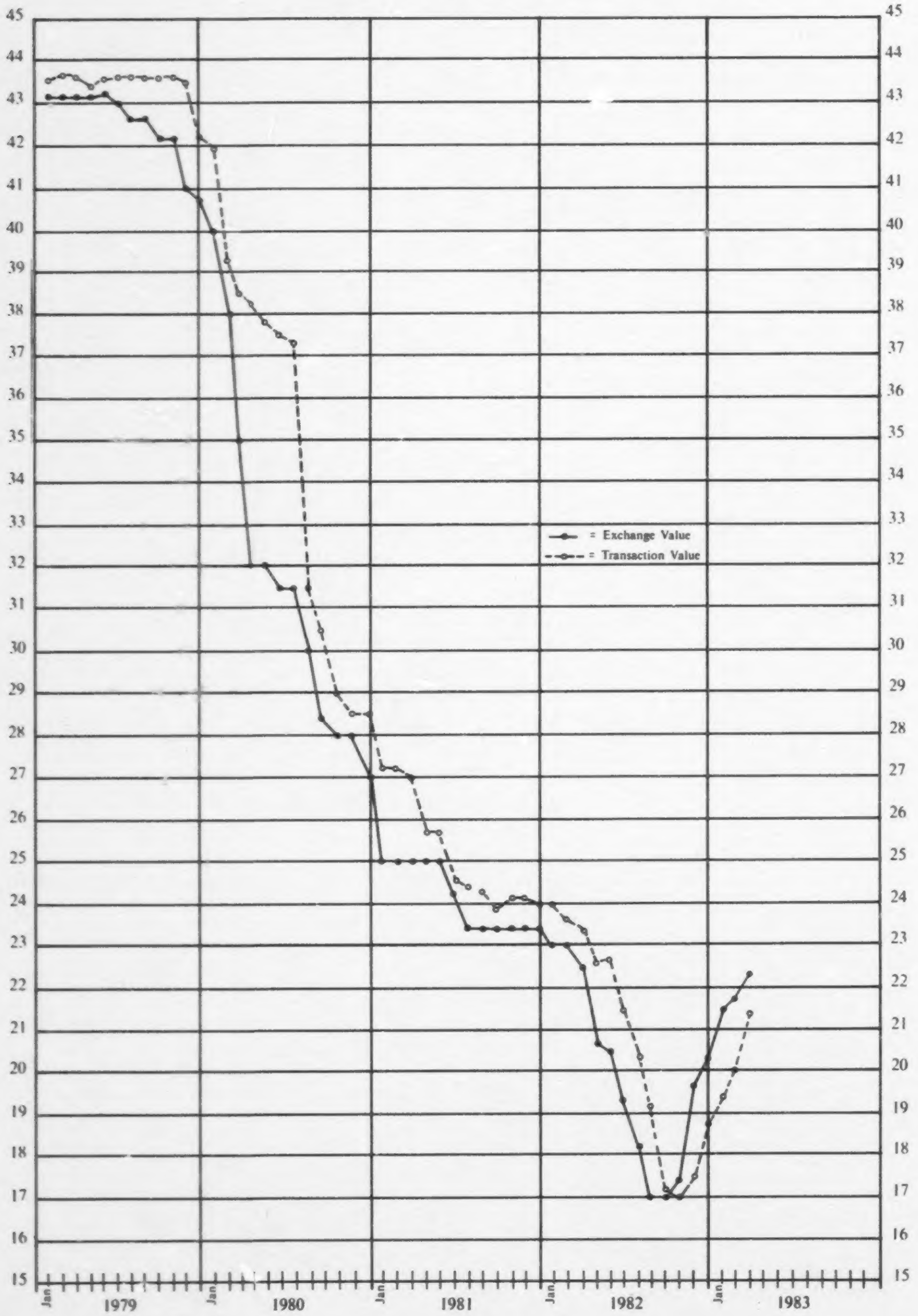
## EXCHANGE AND TRANSACTION VALUES SINCE JANUARY 1979

Determined as of the last day of the month indicated



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*HISTORICAL MARKET DATA*

## HISTORICAL EXCHANGE VALUES

Determined as of the last day of the month indicated (US Dollars/lb. $U_3O_8$)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1968 | — | — | — | — | — | — | — | 6.35 | 6.35 | 6.40 | 6.45 | 6.50 |
| 1969 | — | 6.35 | 6.10 | 6.10 | 6.25 | 6.25 | 6.20 | 6.20 | 6.15 | 6.15 | 6.15 | 6.20 |
| 1970 | 6.30 | 6.30 | 6.30 | 6.30 | 6.30 | 6.30 | 6.30 | 6.20 | 6.15 | 6.15 | 6.15 | 6.15 |
| 1971 | 6.20 | 6.20 | 6.20 | 6.20 | 6.15 | 6.05 | 6.00 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 |
| 1972 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 |
| 1973 | 5.95 | 6.00 | 6.10 | 6.20 | 6.45 | 6.50 | 6.50 | 6.50 | 6.50 | 6.50 | 6.75 | 7.00 |
| 1974 | 7.70 | 7.90 | 8.00 | 9.00 | 9.50 | 10.50 | 11.50 | 12.00 | 12.50 | 14.00 | 14.75 | 15.00 |
| 1975 | 16.00 | 16.00 | 18.00 | 20.00 | 21.00 | 23.00 | 24.70 | 26.00 | 26.00 | 28.50 | 30.00 | 35.00 |
| 1976 | 35.20 | 37.00 | 39.25 | 40.00 | 40.00 | 40.00 | 40.00 | 40.40 | 41.00 | 41.00 | 41.50 | 41.00 |
| 1977 | 41.35 | 41.50 | 41.60 | 41.60 | 42.00 | 42.25 | 42.25 | 42.25 | 42.40 | 42.75 | 43.20 | 43.20 |
| 1978 | 42.90 | 43.25 | 43.25 | 43.25 | 43.40 | 43.40 | 43.40 | 43.10 | 43.25 | 43.00 | 43.25 | 43.25 |
| 1979 | 43.25 | 43.25 | 43.25 | 43.25 | 43.25 | 43.00 | 42.70 | 42.70 | 42.20 | 42.20 | 41.00 | 40.75 |
| 1980 | 40.00 | 38.00 | 35.00 | 32.00 | 32.00 | 31.50 | 31.50 | 30.00 | 28.50 | 28.00 | 28.00 | 27.00 |
| 1981 | 25.00 | 25.00 | 25.00 | 25.00 | 25.00 | 24.25 | 23.50 | 23.50 | 23.50 | 23.50 | 23.50 | 23.50 |
| 1982 | 23.00 | 23.00 | 22.50 | 20.75 | 20.50 | 19.25 | 18.25 | 17.00 | 17.00 | 17.50 | 19.75 | 20.25 |
| 1983 | 21.50 | 21.75 | **22.25** | | | | | | | | | |

## HISTORICAL TRANSACTION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. $U_3O_8$)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1976 | — | — | — | — | 39.60 | 39.70 | 39.70 | 40.40 | 40.30 | 40.60 | 40.70 | 40.70 |
| 1977 | 41.30 | 41.30 | 41.40 | 41.50 | 42.80 | 42.90 | 43.00 | 42.60 | 42.50 | 42.80 | 42.90 | 42.90 |
| 1978 | 43.10 | 43.30 | 43.70 | 43.60 | 43.60 | 43.20 | 43.30 | 43.40 | 43.40 | 43.60 | 43.40 | 43.70 |
| 1979 | 43.60 | 43.80 | 43.70 | 43.40 | 43.60 | 43.70 | 43.70 | 43.60 | 43.60 | 43.60 | 43.50 | 42.30 |
| 1980 | 42.00 | 39.30 | 38.60 | 38.40 | 37.90 | 37.60 | 37.30 | 31.60 | 30.60 | 29.00 | 28.70 | 27.70 |
| 1981 | 27.20 | 27.20 | 27.00 | 25.70 | 25.70 | 24.50 | 24.40 | 24.30 | 23.90 | 24.10 | 24.10 | 24.00 |
| 1982 | 24.00 | 23.70 | 23.40 | 22.60 | 22.70 | 21.50 | 20.30 | 19.10 | 17.30 | 17.00 | 17.55 | 18.80 |
| 1983 | 19.35 | 20.00 | **21.35** | | | | | | | | | |

## HISTORICAL CONVERSION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. $U_6$)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1981 | 1.20 | 1.20 | 1.20 | 1.40 | 1.15 | 1.15 | 1.15 | 1.10 | 1.10 | 1.10 | 1.20 | 1.20 |
| 1982 | 1.20 | 1.20 | 1.20 | 1.20 | 1.00 | 1.00 | 1.00 | 0.90 | 1.10 | 1.60 | 1.45 | 1.45 |
| 1983 | 1.20 | 1.40 | **1.40** | | | | | | | | | |

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## AUSTRALIA

| | Price Index of Materials Used in Manufacturing Industry—All Groups (Year 1968-69 = 100.0)[1] | Award Rates of Pay Indexes Australia—Adult Males In Mining Wage Earners, Weekly Rates (Year 1976 = 100.0)[2] |
|---|---|---|
| Annual Avg. 1972[3] | 105.6 | 71.26 |
| Annual Avg. 1973[3] | 124.4 | 78.96 |
| Annual Avg. 1974[3] | 141.9 | 108.07 |
| Annual Avg. 1975[3] | 150.4 | 132.55 |
| Annual Avg. 1976[3] | 168.4 | 160.93 |
| Annual Avg. 1977[3] | 192.0 | 179.03 |
| Annual Avg. 1978[3] | 198.5 | 190.04 |
| Annual Avg. 1979 | 248.8 | 196.34 |
| Annual Avg. 1980 | 321.8 | 218.00 |
| Annual Avg. 1981 | 355.3 | 237.34 |
| Annual Avg. 1982 | 367.9 | — |
| Oct 1981 | 352.5 | 155.6[2] |
| Nov 1981 | 351.3 | 157.6R[2] |
| Dec 1981 | 349.9 | 167.6R[2] |
| Jan 1982 | 354.9 | 169.5R[2] |
| Feb 1982 | 356.7 | 171.1R[2] |
| Mar 1982 | 360.3 | 171.5R[2] |
| Apr 1982 | 367.7 | 171.5R[2] |
| May 1982 | 367.6 | 172.0R[2] |
| Jun 1982 | 367.2 | 173.2R[2] |
| Jul 1982 | 369.1 | 177.3R[2] |
| Aug 1982 | 371.5 | 178.2R[2] |
| Sep 1982 | 374.0 | 178.3R[2] |
| Oct 1982 | 377.2 | 178.4R[2] |
| Nov 1982 | 374.5P | 178.5R[2] |
| Dec 1982 | 373.6P | 179.5[2] |

P = Preliminary R = Revised since last month

[1] Australian Bureau of Statistics, Canberra: "Price Index of Materials Used in Manufacturing Industry" (Catalogue No. 6411.0), Table 3.

[2] Australian Bureau of Statistics, Canberra: "Award Rates of Pay Indexes, Australia" (Catalogue No. 6312.0), Table 8. Figures are being converted to an Index number. As the data are converted, the new index numbers will be inserted. Figures for the latest fourteen months shown are subject to revision.

[3] Monthly data for 1970 through 1978 appear on pages 4.7 and 4.8 of Nuexco Report 138.

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*GOVERNMENT STATISTICS*

## CANADA

| | Industry Selling Price Index: Manufacturing (D 500000)[1] [2] (1971 = 100.0) | Wage-earner Data: Average Hourly Earnings (C$)[4] [5] | | |
|---|---|---|---|---|
| | | **Metal Mining, including Milling (SIC 050-099)[3]** | **Primary Metal Industries, non-ferrous (SIC 296-298)** | **Chemicals and Chemical Products (SIC 370-379)** |
| Annual Avg. 1978 | 190.4 | 8.75 | 6.82 | 6.97 |
| Annual Avg. 1979 | 217.9 | 9.66 | 7.35 | 7.67 |
| Annual Avg. 1980 | 247.2 | 10.80 | 8.05 | 8.50 |
| Annual Avg. 1981 | 288.7 | 12.23 | 9.03 | 9.53 |
| Dec 1981 | 280.0 | 12.96 | 9.42 | 10.03 |
| Jan 1982 | 281.9 | 13.49 | 9.53 | 10.11 |
| Feb 1982 | 283.5 | 13.61 | 9.60 | 10.19 |
| Mar 1982 | 284.8 | 13.74 | 9.62 | 10.35 |
| Apr 1982 | 287.7 | 13.81 | 9.79 | 10.48 |
| May 1982 | 288.8 | 13.86 | 9.88 | 10.62 |
| Jun 1982 | 289.7 | 13.83 | 9.92 | 10.69 |
| Jul 1982 | 290.3 | 14.02 | 10.05 | 10.73 |
| Aug 1982 | 290.3R | 14.23 | 10.03 | 10.80 |
| Sep 1982 | 292.5R | 14.01 | 10.18 | 10.73 |
| Oct 1982 | 292.2R | 13.88R | 10.18 | 10.86R |
| Nov 1982 | 291.4R | 14.34R | 10.43R | 10.90P |
| Dec 1982 | 292.3R | 14.26P | 10.57P | 11.08P |
| Jan 1983 | 292.7 | — | — | — |
| Feb 1983 | 293.6 | — | — | — |

P = Preliminary    R = Revised since last month

[1] Statistics Canada, Prices Division, Ottawa; "Industry Price Indexes" (Catalogue 62-011), Table 1. Indexes for the most recent six months shown are subject to revision.

[2] Monthly data for 1973 through 1978 appear on page 4.10 of Nuexco Report 138.

[3] The wage earner series in Nuexco reports prior to March 1983 was Metals (SIC 050-059).

[4] Statistics Canada, Labour Division, Employment and Payrolls Section, Ottawa; "Employment, Earnings and Hours" (Catalogue 72-002), Table 2.

[5] Monthly data for 1977 and 1978 appear on page 4.11 of Nuexco Report 138.

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## REPUBLIC OF SOUTH AFRICA

| | Average Declared Working Costs per Metric Ton of Gold Ore Milled (Rand)[1] | Consumer Price Index[2] (1975 = 100, except where otherwise indicated) | Producer[5] Price Index All Groups (1975 = 100) | Total Employment in Mining and Quarrying (Code 35)[7] | Total Salaries and Wages in Mining and Quarrying (1,000 Rand) (Code 40)[7] |
|---|---|---|---|---|---|
| Annual Avg. 1971[3] | 7.88 | 106.4[4] | 59.1 | 652,294 | 415,956 |
| Annual Avg. 1972[3] | 8.79 | 113.3[4] | 63.9 | 623,067 | 443,933 |
| Annual Avg. 1973[3] | 10.51 | 124.1[4] | 72.3 | 684,743 | 572,133 |
| Annual Avg. 1974[3] | 13.18 | 138.5[4] | 85.3 | 674,140 | 761,596 |
| Annual Avg. 1975[3] | 16.71 | 157.2[4] | 100.0 | 639,473 | 1,003,617 |
| Annual Avg. 1976[3] | 19.30 | 174.7[4] | 115.1 | 671,240 | 1,212,983 |
| Annual Avg. 1977[3] [6] | 23.87 | 194.4[4] | 130.0 | 712,006 | 1,420,670 |
| Annual Avg. 1978[3] [6] | 27.14 | 137.2 | 142.7 | 664,571 | 1,537,169 |
| Annual Avg. 1979[3] [6] | 30.18 | 155.3 | 164.5 | 692,209 | 1,830,632 |
| Annual Avg. 1980[6] | 35.53 | 176.7 | 192.1 | 714,379 | 2,279,615 |
| Annual Avg. 1981 | 41.89 | 206.5 | 218.3 | 728,506 | 2,820,505 |
| Sep 1981 | 43.28 | 211.6 | 224.6 | 724,604 | 251,502 |
| Oct 1981 | — | 213.4 | 227.0 | 717,918 | 248,159 |
| Nov 1981 | — | 214.8 | 229.4 | 720,255 | 253,044 |
| Dec 1981 | 44.52 | 216.3 | 230.4 | 709,612 | 257,655 |
| Jan 1982 | — | 217.6 | 233.1 | 700,375 | 257,173 |
| Feb 1982 | — | 220.2 | 236.8 | 705,992 | 250,191 |
| Mar 1982 | 45.49 | 225.2 | 237.4 | 725,700 | 262,210 |
| Apr 1982 | — | 228.9 | 241.9 | 707,502 | 252,562 |
| May 1982 | — | 230.3 | 244.8 | 715,162 | 258,770 |
| Jun 1982 | 45.77 | 232.1 | 246.7 | 707,552 | 261,361 |
| Jul 1982 | — | 234.1 | 249.4 | 702,141 | 283,248 |
| Aug 1982 | — | 236.8 | 253.4 | 705,562 | 276,730 |
| Sep 1982 | 48.04 | 241.0 | 255.0 | 704,344R | 282,782R |
| Oct 1982 | — | 243.9 | 260.1 | 701,316 | 285,328 |
| Nov 1982 | — | 245.4 | 262.5 | 707,966 | 287,699 |
| Dec 1982 | 49.62 | 246.2 | 263.0 | — | — |
| Jan 1983 | — | 249.0 | 264.9 | — | — |
| Feb 1983 | — | 253.1 | — | — | — |

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[1] Chamber of Mines of South Africa, Johannesburg; "Analysis of Working Results," published quarterly.
[2] Republic of South Africa Department of Statistics, Pretoria; "Government Gazette: Consumer Price Index for Urban Areas."
[3] Historical data for the Average Declared Working Costs and Consumer Price Index 1970-1979 appear on page 4.9 of Nuexco Report 140.
[4] April 1970 = 100.00.
[5] Previously known as the WHOLESALE PRICE INDEX, now the PRODUCER PRICE INDEX. The computation remains the same.
[6] Historical data for Codes 35 and 40 1977-1980 appear on page 28 of Nuexco Report 157.
[7] Bulletin of Statistics, Department of Statistics, Pretoria.

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*GOVERNMENT STATISTICS*

## UNITED STATES

|  | Producer Price Index—Industrial Commodities (1967 = 100)[1] | Producer Price Index—All Commodities (1967 = 100)[1] | Consumer Price Index (1967 = 100)[2] | GNP Implicit Price Deflator (1972 = 100)[3] | Gross Average Hourly Earnings of Production or Non-supervisory Workers (US$)[4] |  |  |  |
|---|---|---|---|---|---|---|---|---|
|  |  |  |  |  | Metal Mining (SIC 10) | Primary Non-ferrous Metals (SIC 333) | Chemicals and Allied Products (SIC 28) | Electric and Electronic Equipment (SIC 36) |
| Annual Avg. 1972[5] | 117.9 | 119.1 | 125.3 | 100.00 | 4.56 | 4.59 | 4.26 | 3.71 |
| Annual Avg. 1973[5] | 125.9 | 134.7 | 133.1 | 105.75 | 4.84 | 4.98 | 4.51 | 3.91 |
| Annual Avg. 1974[5] | 153.8 | 160.1 | 147.7 | 115.08 | 5.44 | 5.63 | 4.88 | 4.21 |
| Annual Avg. 1975[5] | 171.5 | 174.9 | 161.2 | 125.79 | 6.13 | 6.24 | 5.39 | 4.64 |
| Annual Avg. 1976[5] | 182.4 | 183.0 | 170.5 | 132.34 | 6.76 | 6.87 | 5.91 | 4.96 |
| Annual Avg. 1977[5] | 195.1 | 194.2 | 181.5 | 140.05 | 7.28 | 7.67 | 6.43 | 5.39 |
| Annual Avg. 1978[5] | 209.4 | 209.3 | 195.4 | 150.42 | 8.23 | 8.56 | 7.02 | 5.82 |
| Annual Avg. 1979[5] | 236.5 | 235.6 | 217.4 | 163.42 | 9.27 | 9.50 | 7.60 | 6.32 |
| Annual Avg. 1980[5] | 274.8 | 268.8 | 246.8 | 178.64 | 10.26 | 10.63 | 8.30 | 6.94 |
| Annual Avg. 1981 | 304.1 | 293.4 | 272.4 | 195.51 | 11.55 | 11.98 | 9.12 | 7.62 |
| Annual Avg. 1982 | 312.3P | 299.3P | 289.1 | 207.15 | 12.31 | 12.90 | 9.98 | 8.17 |
| Feb 1982 | 311.4 | 298.5 | 283.4 | — | 12.22 | 12.61 | 9.68 | 7.96 |
| Mar 1982 | 311.0 | 298.0 | 283.1 | 203.68 | 12.29 | 12.69 | 9.71 | 8.01 |
| Apr 1982 | 309.9 | 298.0 | 284.3 | — | 12.23 | 12.68 | 9.81 | 8.03 |
| May 1982 | 309.6 | 298.6 | 287.1 | — | 12.25 | 12.71 | 9.83 | 8.05 |
| Jun 1982 | 310.6 | 299.3 | 290.6 | 205.98 | 12.26 | 12.91 | 9.95 | 8.09 |
| Jul 1982 | 312.8 | 300.4 | 292.2 | — | 12.23 | 12.91 | 10.02 | 8.18 |
| Aug 1982 | 313.2 | 300.2 | 292.8 | — | 12.29 | 12.97 | 10.03 | 8.24 |
| Sep 1982 | 312.7 | 299.3 | 293.3 | 208.51 | 12.53 | 13.46 | 10.20 | 8.31 |
| Oct 1982 | 314.3R | 299.8 | 294.1 | — | 12.50 | 13.22 | 10.24 | 8.34 |
| Nov 1982 | 315.1P | 300.4P | 293.6 | — | 12.52 | 13.18 | 10.28 | 8.38 |
| Dec 1982 | 315.0P | 300.6P | 292.4 | 210.42 | 12.52R | 13.01R | 10.34 | 8.45R |
| Jan 1983 | 314.0P | 300.0P | 293.1 | — | 12.57P | 13.29P | 10.35P | 8.47P |
| Feb 1983 | 314.4P | 301.2P | 293.2 | — | — | — | 10.40P | 8.53P |

P = Preliminary R = Revised since last month

[1] US Bureau of Labor Statistics, Washington, D.C.; "Producer Prices and Price Indexes," Table 6 (formerly "Wholesale Prices and Price Indexes"). Producer Price Indexes are revised four months after they are first released to reflect the availability of late reports and corrections by respondents.

[2] US Bureau of Labor Statistics, Washington, D.C.; Consumer Price Index for All Urban Consumers, US City Average, All Items.

[3] US Department of Commerce, Washington, D.C.; Bureau of Economic Analysis, National Income and Wealth Division; "Survey of Current Business," Table A. The GNP Implicit Price Deflator is published quarterly, and seasonally adjusted.

[4] US Bureau of Labor Statistics, Washington, D.C.; "Employment and Earnings," Table C-2. All data based on 1972 revision of SIC Manual. Data for 1970-1976 are adjusted to the March 1977 benchmark. Data for 1977-1978 are adjusted to the March 1979 benchmark. Data for January 1979 and beyond are adjusted to the March 1980 benchmark.

[5] Monthly data 1970-1978 for Producer Price Index-Industrial Commodities, Consumer Price Index, and Employment and Earnings SIC codes 10, 333, and 28, and quarterly data for GNP Implicit Price Deflator appear on pages 4.6-4.8 of Nuexco Report 139.
Monthly data 1977-1978 for Employment and Earnings SIC Codes 10, 333, and 28 appear on page 33 of Nuexco Report 147.
Monthly data 1970-1978 for Employment and Earnings SIC Code 36 appear on page 23 of Nuexco Report 154.
Monthly data 1979-1980 for Employment and Earnings, Revised Establishment Data, all listed codes, appear on page 22 of Nuexco Report 158.
Monthly data 1977-1980 for Producer Price Index-All Commodities, appear on page 21 of Nuexco Report 158.

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# NUEXCO

MAY 1983 NUMBER 177

# Monthly Report on the Nuclear Fuel Market

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## EXECUTIVE SUMMARY
## REPORT 177

**Exchange Value Rose $1.00, to $23.25**

The **Exchange Value** as of April 30, 1983 is **$23.25** per pound $U_3O_8$. Five spot or near-term sales are reported, involving approximately 1.6 million pounds $U_3O_8$, *equivalent.*

**Near-term Supply-Demand Ratio Increased to 3.4:1**

**Active** spot and near-term **uranium supply** amounts to **8.6 million** pounds $U_3O_8$, *equivalent*, up 15% from last month. **Active** spot and near-term **uranium demand** declined 10%, to **2.6 million** pounds $U_3O_8$ equivalent. Therefore, the spot and near-term **supply-demand ratio** increased 30 percent, to **3.4:1**.

**Transaction Value Rose $0.05, to $21.40**

The **Transaction Value** as of April 30, 1983, is **$21.40** per pound $U_3O_8$. It includes 13 transactions involving a total of 2.8 million pounds $U_3O_8$ and covers a period of four months.

**Conversion Value Declined $0.20, to $1.20**

The **Conversion Value** as of April 30, 1983 is **$1.20** per pound U as $UF_6$, down $0.20 since last month. No conversion transactions are reported. Active sellers are offering 4.0 million pounds U in near-term conversion services, up 33% since last month. Active demand increased 50%, to 1.1 million pounds U.

**Loan Use Charge Rate Steady at 6%**

The **Loan Use Charge Rate** as of April 30, 1983 is **6 percent** per annum. One loan transaction is reported. Total quantity involved is approximately one million pounds $U_3O_8$.

**SWU Values:**
**FY83 $103, down $3**
**FY84 $109, down $1**

As of April 30, 1983 the **SWU Value for FY83** is **$103** per SWU, down $3 from last month. That price reflects the dominance of the market by sellers of large quantities of Eurodif-origin SWUs, who are offering significant net discounts relative to the DOE price for SWUs purchased under requirements contracts. Prices offered by those few sellers of DOE SWU remaining in the market are approximately $120 per SWU. The only potential buyers for sizable blocks of FY83 SWU on the secondary market are holders of DOE requirements contracts having 3.5-year termination provisions. However, there are very few who would be willing to terminate at this late date in order to enter the secondary market.

As of April 30, 1983 the **SWU Value for FY84** is $109 per SWU, down $1 from last month. For FY84 SWUs, there is no large differential between prices being offered by sellers of DOE and Eurodif-origin SWUs. This segment of the market is the most active at present. The market for FY85 and beyond remains quiet, awaiting DOE's revelation of the terms and conditions of conversion to the FR contract.

**Africa**

During the first quarter of 1983, South Africa's overall uranium production from gold-uranium operations, 3.7 million pounds $U_3O_8$, was essentially unchanged from the fourth quarter of 1983.

**Australia**

Discusses implications of Labor Party's election victory.

**Canada**

Federal government insistence on "upgrading" to $UF_6$ all uranium exports could give US and South African sellers a large commercial advantage.

**United States**

US Supreme Court upheld California powerplant siting law banning new nuclear plants if permanent disposal of radioactive waste is not provided for, but this action will have no practical effect on the nuclear fuel market.

*This Executive Summary may be reproduced for internal distribution.*

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# NUEXCO REPORT 177
# FIGURES OF THE MONTH
(April 30, 1983)

| | This Month (Report 177) | Last Month (Report 176) | 12 Months Ago (Report 165) |
|---|---|---|---|
| Exchange Value[1] | 23.25 | 22.25 | 20.75 |
| Transaction Value[1] | 21.40 | 21.35 | 22.60 |
| Conversion Value[2] | 1.20 | 1.40 | 1.20 |
| Loan Use Charge Rate[3] | 6% | 6% | 6% |
| Near-Term Uranium Supply[4] | 8.6 | 7.5 | 13.0 |
| Near-Term Uranium Demand[5] | 2.6 | 2.9 | 1.4 |
| Near-Term Supply-Demand Ratio | 3.4 | 2.6 | 9.3 |
| Current Transactions[6]: | | | |
| Number of Transactions | 6 | 7 | 3 |
| Quantity of Material[7] | 1.6-2.8 | 6.7-7.4+ | 0.7-1.4 |
| SWU Prices[8]: | | | |
| Nuexco SWU Values: | | | |
| FY 83 | 103 | 106 | — |
| FY 84 | 109 | 110 | — |
| USDOE SWU Prices: | | | |
| AFC | 138.65 | 138.65 | 130.75 |
| Requirements | 149.85 | 149.85 | 138.37 |
| Market Value of Enriched $UF_6$[9] [10]: | | | |
| 2.5 w/o $U_{235}$ | 616.52 | 616.48 | — |
| 3.0 w/o $U_{235}$ | 789.24 | 790.32 | — |
| 3.5 w/o $U_{235}$ | 965.04 | 967.34 | — |
| 4.0 w/o $U_{235}$ | 1,143.13 | 1,146.70 | — |

---

[1] US $ per pound $U_3O_8$ equivalent

[2] US $ per pound U as $UF_6$

[3] Per annum

[4] Active inquiries to sell, for delivery within 12 months after contract signing (millions of pounds $U_3O_8$)

[5] Active inquiries to purchase, for delivery within 12 months after contract signing (millions of pounds $U_3O_8$)

[6] Uranium sales only; does not include loans, conversion, or SWU transactions

[7] Millions of pounds $U_3O_8$, equivalent

[8] US $ per SWU

[9] Calculated using the Nuexco Exchange Value, Conversion Value, and 0.20 percent tails assay. Calculations before 2/28/83 used the USDOE price for AFC SWUs. As of 2/28/83, calculations use the Nuexco SWU Value for the relevant fiscal year (currently FY 83).

[10] US $ per KgU as $UF_6$

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# MONTHLY REPORT ON THE URANIUM MARKET

May 1983 No. 177

R. WESLEY MILLER, *EDITOR*

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## FOREWORD

Nuexco will host a hospitality suite during the Atomic Industrial Forum/FORATOM International Fuel Cycle Conference in Geneva, Switzerland. The suite will be at the Hotel Intercontinental, May 31-June 3. We look forward to seeing you in Geneva.

* * *

We are pleased to announce that Mr. **Christian (Chris) C. Guitton** joined Nuexco this month as a Marketing Representative. Chris will assist Wayne Fowler in our uranium brokerage operations.

Chris was previously employed at General Electric in the Nuclear Energy Business Group, where he was a Senior Engineer and Manager of the Prototype Fuel Program. He holds a French national diploma (Ecole Nationale Supérieure de Mécanique et d'Aérotechnique), and a Master of Science degree in mechanical engineering (University of Poitiers, France). Chris also holds a California license as a Professional Engineer.

Mr. **James E. Vaughan** addressed the Southern African Metals and Minerals Conference in Johannesburg on April 22, and Mr. **Peter R. Stork** addressed the Annual Petroleum & Mineral Review Conference of Australia's Academy of Science in Canberra on March 23. Copies of their speeches are enclosed with this Report.

* * *

## NATURAL URANIUM AND CONVERSION

The **Exchange Value** as of April 30, 1983 rose for the seventh consecutive month, to **$23.25** per pound $U_3O_8$, up $1.00 since last month. Psychological factors account for the increase. Buyers are simply willing to pay higher prices, as they observe the price recovery which has taken place. However, those buyers who are in the market are exercising discretion, while most sellers holding larger lots are demanding more price incentive before actively participating.

The *Current Market Data* section lists six uranium sales transactions, amounting to more than ten million pounds $U_3O_8$, equivalent. The five spot or near-term transactions accounted for approximately 1.6 million pounds of the total.

**Active spot and near-term uranium supply** (material offered at competitive prices, terms, and other conditions) amounts to **8.6 million** pounds $U_3O_8$ equivalent, up 15 percent from last month's level of 7.5 million. **Active spot and near-term uranium demand** declined to **2.6 million** pounds $U_3O_8$, equivalent. Therefore, the spot and near-term **supply-demand ratio** increased to **3.4:1**, 30 percent higher than last month's level of 2.6.

* * *

The **Transaction Value** as of April 30, 1983 is **$21.40** per pound $U_3O_8$, equivalent, an increase of $0.05 since last month. Although five spot or near-term transactions are reported this month, few met the standards for inclusion in the Transaction Value calculation. The current Transaction Value includes 13 transactions involving a total of 2.8 million pounds $U_3O_8$ equivalent, and covers a period of four months.

* * *

The **Conversion Value** as of April 30, 1983 is **$1.20** per pound $UF_6$, down $0.20 from last month. No conversion transactions are reported this month. **Spot and near-term conversion supply** (active inquiries to sell conversion services within one year) totals **4.0 million** pounds U, up 33 percent since last month. **Spot and near-term conversion demand** increased by approximately 50 percent, to **1.1 million** pounds U.

The Conversion Value's fourteen percent drop was due to multiple factors, foremost among them the pressure exerted by sellers offering large quantities of secondary market conversion services at or near the current Conversion Value. Although demand has increased, especially in Europe, secondary market conversion supply still outweighs demand by a margin of almost 4 to 1.

* * *

The **Loan Use Charge Rate** remained at six percent per annum. Although one lender has been successful at or near 7 percent, their remaining material would be available for loan as $UF_6$ only. Nuexco is aware of at least three lenders holding a total of more than three million pounds available for loan as $U_3O_8$ at 6 percent per annum, but there are few potential borrowers. One loan transaction is reported this month. The total quantity involved is approximately one million pounds $U_3O_8$.

* * *

The recovery of spot market prices has now continued for seven months. The current Exchange Value approximates market levels prior to the 1982 price break. That break, which saw prices bottom at $17 per pound $U_3O_8$, was stimulated by intense competition among utilities liquidating inventory and producers selling excess production amounting to more than 15 million pounds $U_3O_8$.

The recovery must, however, be viewed in its proper context.

1. While any price strengthening is viewed enthusiastically by producers, such enthusiasm should be tempered by the reality that spot market prices have not quite recovered to the levels of late 1981.

2. Substantial inventory, which Nuexco estimates at more than 20 million pounds $U_3O_8$, remains subject to near-term liquidation. Some of this market is held by producers lacking forward delivery commitments. The largest amount, however, is held by utilities that have financial difficulties or lagging nuclear programs. It seems likely that much of this material will find its way into the market in the near term.

3. While consumption is increasing from year to year as new plants begin operations, annual uranium production, even as the industry contracts rapidly, remains considerably greater than annual consumption. The result is a continuing inventory buildup. Much of this production continues to be delivered, under long-term contracts, to those very utilities that need it least, further increasing the likelihood of liquidation and consolidation in the producer sector.

4. Current spot prices are substantially lower than the prices needed for profitable uranium production in most of the world. Most producers are unwilling to guarantee delivery over the longer term at spot market price levels. Thus, those buyers whose internal policies or regulatory pressures have caused them to insist on spot market pricing find it difficult, if not impossible, to conclude new longer-term supply agreements. Some intermediate

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and longer-term needs probably will be filled by purchases in the spot market well in advance of need (early procurement).

These factors suggest that the spot market in the near term will be described by one of three scenarios.

Under the first scenario, further inventory liquidation will be minimal and spot prices will rise in response to buying pressure. This buying pressure would likely accelerate as the perception grew that the excess inventory would not be liquidated. In such an event, spot market prices could reach the range of $28 to $31 per pound $U_3O_8$.

The second scenario, which represents the opposite extreme, is a renewed period of inventory liquidation. Its obvious effect would be to drive spot prices down again. In this instance, the possibility of spot prices once again falling below $20 would be quite real.

A third scenario is one in which neither extreme would be realized. Enough inventory would be sold to suppress a large price increase, but the quantities would not be so large as to bring about a new collapse. Early procurement would provide additional support if prices tended to weaken. Under this scenario, spot prices could remain in the range of $22 to $26 per pound $U_3O_8$ for the near term.

The uranium spot market can be extremely volatile. Unforeseen events such as war, political instability, abrupt changes in national energy plans, or economic stress can overnight invalidate the most carefully conceived forecasts and strategies. It would be risky to formulate a market strategy suitable for only one of the three postulated scenarios. Rather, market participants should formulate a strategy having sufficient flexibility to respond to unexpected price movements.

## ENRICHED URANIUM AND SWUs

As of April 30, 1983 the **SWU Value for FY 1983** is **$103** per SWU, down $3 from a month ago. This price reflects the dominance of the market by sellers of large quantities of Eurodif-origin SWUs who are offering significant net discounts relative to the DOE price for SWUs purchased under requirements contracts. Even though, at present, there are virtually no DOE-origin SWUs being offered on the secondary market at competitive prices for FY 1983 delivery, competition among sellers has enabled the few buyers to obtain prices approximately $10 below their break-even prices of $112.39 ($149.85 for DOE requirements contracts, less 25 percent penalty for partial termination of a requirements contract having 3.5-year termination provisions).

The potential market for sizable blocks of SWU for FY 1983 delivery is still comprised of those DOE customers holding requirements contracts having 3.5-year termination provisions. Among that group, there are very few, if any, having FY 1983 deliveries who would be willing to terminate at this late date and buy replacement SWUs on the secondary market. DOE's standard policy requires 6 months' notice for the specification of enrichment assays and quantities to be delivered, so most such buyers who were willing to use the secondary market have already terminated and purchased replacement SWU before the six-month deadline. It is unlikely that many new such buyers will enter the market at this late stage.

The few sellers of DOE-origin SWU for FY 1983 delivery are presently offering at approximately $120 per SWU (at 0.20 percent tails assay). They are primarily holders of enriched product inventory wishing to sell SWU by means of de-enrichment swaps. There is little interest at present for buyers in completing transactions at this price level. However, there are some potential buyers of FY 1983 seeking small quantities in excess of their requirements contract appendix A ceilings, or due to unexpected changes in their fuel needs. Any such buyers would likely have to pay prices substantially above $103, the current SWU Value for FY 1983, if they wished to purchase DOE-origin SWUs.

As of April 30, 1983 the **SWU Value for FY 1984** is **$109** per SWU, down $1 since last month. The price reflects SWU prices available for delivery in FY 1984 from sellers of both Eurodif-origin and DOE-origin SWU. This segment of the secondary SWU market is very active. A number of buyers holding DOE requirements contracts having 3.5-year termination provisions are seeking secondary market supply to replace deliveries scheduled for mid-to-late FY 1984. These buyers hope to complete secondary market SWU purchases in time to allow them to terminate their FY 1984 requirements contract deliveries with more than one year's notice. It appears probable that most DOE FY 1984 SWUs now available on the secondary market at competitive prices will be sold within the next few months. In that event, the remaining DOE 3.5-year requirements contract holders who wish to terminate in FY 1984 could face the same choice that many faced in FY 1983, that of whether to accept full-priced supply in the form of DOE-origin SWUs or to purchase Eurodif-origin SWUs at a discount.

The market for FY 1985 and later remains quiet, as it has for the past several months. Potential sellers continue to await DOE's announcement of the terms and conditions of conversion to the FR (Facility Requirements) contract. That announcement had been expected in late April or early May, but has been delayed yet again.

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**EXCHANGE VALUE $23.25/lb. $U_3O_8$**
Determined as of April 30, 1983

**Definition**[1]

The Exchange Value is Nuexco's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the last day of the month.

**Derivation**

Nuexco bases the Exchange Value upon:

A. Data from recently completed transactions.
B. Data from pending transactions.
C. Firm bids to buy and firm offers to sell.
D. Prices purchasers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy, and prices sellers have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell.

**Comments**

Nuexco does not consider the following in determining the Exchange Value:

A. The price of uranium delivered or to be delivered under old contracts.
B. The price of uranium delivered in connection with contract renegotiations or other than arm's length transactions.

[1] In December, 1981, Nuexco published a history of the Exchange Value which chronicled, month-by-month, changes in its definition, usage and derivation. Copies are available upon request.

**TRANSACTION VALUE**[2]
Determined as of April 30, 1983

| $/lb. $U_3O_8$ | Millions of Pounds | Number of Transactions | Number of Months |
|---|---|---|---|
| 21.40 | 2.8 | 13 | 4 |

**Definition**

The Transaction Value is a weighted average price of recent transactions, and is based on prices paid for $U_3O_8$ in transactions closed within the previous three-month period and for which delivery was scheduled within one year of the transaction date. At least ten transactions totaling at least two million pounds $U_3O_8$ are included in each calculation, or the sample time is extended as necessary to include these minima. Foreign currencies are converted to US dollars as of the transaction date.

**Comments**

Nuexco does not consider the following in determining the Transaction Value:

A. The price of uranium delivered in connection with contract renegotiations or other than arm's length transactions.
B. The price of uranium delivered in connection with contracts which call for "market price" mechanisms. This exclusion applies particularly to contracts in which delivery prices are expressed as a function of Exchange Value or any other independent variable. Also excluded from consideration are all data where the delivery price is defined in such a way that it cannot currently be determined.

[2] Transaction Values for 1976 through 1981 and their associated parameters (millions of pounds, number of transactions and number of months) are tabulated on pages 31 and 32 of Report 161. Corresponding data for 1982 are tabulated on page 5 of Report 173.

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*CURRENT MARKET DATA*

**CONVERSION VALUE[1] $1.20/lb. U as $UF_6$**
Determined as of April 30, 1983

**Definition**

The Conversion Value is Nuexco's judgment of the price at which spot and/or near-term transactions for significant quantities of conversion services could be concluded in the secondary market as of the last day of the month.

**Derivation**

Nuexco bases the Conversion Value upon:

A. Data from recently completed transactions.
B. Data from pending transactions.
C. Firm bids to buy and firm offers to sell.
D. Prices purchasers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy, and prices sellers have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell.

**Comments**

Nuexco does not consider the following in determining the Conversion Value:

A. The price of conversion services delivered or to be delivered under old contracts.
B. The price of conversion services delivered in connection with contract renegotiations or other than arm's length transactions.

[1] Monthly data for 1981 and 1982 are tabulated on page 6 of Report 173.

**LOAN USE CHARGE RATE[2] 6%**
Determined as of April 30, 1983

**Definition**

The Loan Use Charge Rate is Nuexco's judgment of the annual interest rate at which uranium loans could be concluded as of the last day of the month.

**Derivation**

Nuexco bases the Loan Use Charge Rate upon:

A. Data from recently completed or pending loan transactions.
B. Rates included in firm proposals to borrow or lend.
C. Rates that potential borrowers and lenders have expressed as a willingness to pay or accept, but for which Nuexco is not aware of firm proposals.

[2] Monthly data for 1968 through 1981 appear on pages 32-34 of Report 162. Monthly data for 1982 appear on page 2 of Report 173.

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*CURRENT MARKET DATA*

**SWU VALUE $103/SWU for FY83**
**SWU VALUE $109/SWU for FY84**
Determined as of April 30, 1983

**Definition**

The SWU (Separative Work Unit) Value is Nuexco's judgment of the price, expressed in US dollars per SWU, at which transactions for the sale of significant quantities of SWU of any origin for delivery in the specified DOE fiscal year could be concluded as of the last day of the month.

**Derivation**

Nuexco bases the SWU Value upon:

A. Data from recently completed transactions.
B. Data from pending transactions.
C. Firm bids to buy and firm offers to sell.
D. Prices purchasers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy, and prices sellers have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell.
E. SWU prices at varying tails assays and varying product assays are converted to the equivalent SWU price at the DOE Reference Transaction Tails Assay (presently 0.20 weight percent $U_{235}$) and a product assay of three percent $U_{235}$ assuming feed costs calculated using the Nuexco Exchange Value and Nuexco Conversion Value determined as of the last day of the same month.

**Comments**

Nuexco does not consider the following in determining the SWU Value:

A. The price of SWU delivered under long-term contracts from primary suppliers, such as DOE, Urenco, or Eurodif.
B. The price of SWU delivered under other than arm's length transactions.

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*CURRENT MARKET DATA*

## EXCHANGE VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

| Country (currency) | per lb. $U_3O_8$ in Concentrates | per kg $U_3O_8$ in Concentrates | per kg U in Concentrates |
|---|---|---|---|
| Australia (dollar) | 26.79 | 59.05 | 69.64 |
| Belgium (comm. franc) | 1,134 | 2,500 | 2,949 |
| Canada (dollar) | 28.52 | 62.87 | 74.14 |
| Finland (markka) | 126.43 | 278.72 | 328.68 |
| France (franc) | 171.46 | 378.00 | 445.76 |
| FRG (mark) | 57.22 | 126.16 | 148.77 |
| Italy (lira) | 34,191 | 75,379 | 88,889 |
| Japan (yen) | 5,532 | 12,195 | 14,381 |
| Netherlands (guilder) | 64.35 | 141.87 | 167.30 |
| South Africa (rand) | 25.34 | 55.87 | 65.88 |
| Spain (peseta) | 3,185 | 7,022 | 8,280 |
| Sweden (krona) | 173.90 | 383.38 | 452.09 |
| Switzerland (franc) | 48.04 | 105.90 | 124.89 |
| UK (pound) | 14.91 | 32.88 | 38.77 |
| US (dollar) | 23.25 | 51.26 | 60.44 |

## TRANSACTION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

| Country (currency) | per lb. $U_3O_8$ in Concentrates | per kg $U_3O_8$ in Concentrates | per kg U in Concentrates |
|---|---|---|---|
| Australia (dollar) | 24.65 | 54.35 | 64.10 |
| Belgium (comm. franc) | 1,044 | 2,301 | 2,714 |
| Canada (dollar) | 26.25 | 57.87 | 68.24 |
| Finland (markka) | 116.37 | 256.55 | 302.53 |
| France (franc) | 157.82 | 347.93 | 410.29 |
| FRG (mark) | 52.67 | 116.12 | 136.93 |
| Italy (lira) | 31,471 | 69,381 | 81,816 |
| Japan (yen) | 5,092 | 11,225 | 13,237 |
| Netherlands (guilder) | 59.23 | 130.58 | 153.99 |
| South Africa (rand) | 23.32 | 51.42 | 60.64 |
| Spain (peseta) | 2,932 | 6,463 | 7,621 |
| Sweden (krona) | 160.06 | 352.87 | 416.12 |
| Switzerland (franc) | 44.21 | 97.48 | 114.95 |
| UK (pound) | 13.73 | 30.26 | 35.69 |
| US (dollar) | 21.40 | 47.18 | 55.64 |

[1] Calculated using currency exchange rates published in the Wall Street Journal on April 29, 1983.

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## CONVERSION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

| Country (currency) | per lb. U as $UF_6$ | per kg U as $UF_6$ |
|---|---|---|
| Australia (dollar) | 1.38 | 3.05 |
| Belgium (comm. franc) | 58.54 | 129.05 |
| Canada (dollar) | 1.47 | 3.25 |
| Finland (markka) | 6.53 | 14.39 |
| France (franc) | 8.85 | 19.51 |
| FRG (mark) | 2.95 | 6.51 |
| Italy (lira) | 1,765 | 3,891 |
| Japan (yen) | 285.51 | 629.44 |
| Netherlands (guilder) | 3.32 | 7.32 |
| South Africa (rand) | 1.31 | 2.88 |
| Spain (peseta) | 164.38 | 362.40 |
| Sweden (krona) | 8.98 | 19.79 |
| Switzerland (franc) | 2.48 | 5.47 |
| UK (pound) | 0.77 | 1.70 |
| US (dollar) | 1.20 | 2.65 |

## SWU VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

| Country (currency) | FY 1983 per SWU | FY 1984 per SWU |
|---|---|---|
| Australia (dollar) | 118.66 | 125.58 |
| Belgium (comm. franc) | 5,024 | 5,317 |
| Canada (dollar) | 126.33 | 133.69 |
| Finland (markka) | 560.09 | 592.71 |
| France (franc) | 759.59 | 803.83 |
| FRG (mark) | 253.51 | 268.27 |
| Italy (lira) | 51,471 | 60,294 |
| Japan (yen) | 24,506 | 25,934 |
| Netherlands (guilder) | 285.08 | 301.69 |
| South Africa (rand) | 112.26 | 118.80 |
| Spain (peseta) | 14,110 | 14,932 |
| Sweden (krona) | 770.38 | 815.26 |
| Switzerland (franc) | 212.81 | 225.21 |
| UK (pound) | 66.07 | 69.92 |
| US (dollar) | 103.00 | 109.00 |

[1] Calculated using currency exchange rates published in the Wall Street Journal on April 29, 1983.

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*CURRENT MARKET DATA*

## TRANSACTION SUMMARY[1]

### Uranium Transactions

| Nuexco Transaction Number | Delivery Period | Approximate Quantity (thousands of pounds, $U_3O_8$ equivalent) | Approximate Price as Percent of Current E.V. | Seller | Buyer | Remarks |
|---|---|---|---|---|---|---|
| 2222 | 1983 | 601-1000 | Less than 100 | European Entity | European Entity | Some $UF_6$ |
| 2252 | 1983 | Less than 50 | 103 | US Producer | US Producer | |
| 2277 | 1983 | 51-100 | Less than 91 | European Utility | European Utility | $UF_6$ |
| 2294 | 1983 | Less than 50 | 101 | European Utility | US Producer | |
| 2297 | 1985-95 | 601-1000 per year | indeterminate | Canadian Producer | European Utility | Not arm's length. Price related to market. Pending gov't approvals. |
| 2303 | 1983 | 301-600 | indeterminate | Canadian Producer | US Producer | Pending gov't approval. |

### Conversion Transactions

| Nuexco Transaction Number | Delivery Period | Approximate Quantity (thousands of pounds, U equivalent) | Approximate Price as Percent of Current C.V. | Seller | Buyer | Remarks |
|---|---|---|---|---|---|---|

There are no conversion transactions reported this month.

### Loan Transactions

| Nuexco Transaction Number | Delivery Period | Approximate Quantity (thousands of pounds, $U_3O_8$ equivalent) | Approximate Price as Percent of Current L.U.C.R. | Lender | Borrower | Remarks |
|---|---|---|---|---|---|---|
| 2281 | 1983 | 601-1000 | 108 | US Utility | US Producer | |

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[1] Transactions listed are not limited to those in which Nuexco was involved, but also include others of which Nuexco is aware.

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## URANIUM SUPPLY
## (As of 4/30/83)

| Nuexco Project Number | Delivery Period[1] (Thousands of Pounds $U_3O_8$) Within 1 Year | Beyond 1 Year | Remarks |
|---|---|---|---|
| **Available for Sale:** | | | |
| **ACTIVE** | | | |
| 1575 | | 500 per year | Long Term |
| 1818 | 150 | 250 per year | Long Term |
| 1921 | 2,100 | | $UF_6$ |
| 2017 | | 2,300 | |
| 2038 | 2,000 | | $UF_6$ |
| 2056 | 2,200 | | $UF_6$ |
| 2134 | | 300 per year | Long Term |
| 2158 | 300 | | |
| 2162 | 275 | | Some $UF_6$ |
| 2191 | 125 | | $UF_6$ |
| 2193 | | 800 | 1986-90 |
| 2203 | 1,200 | | |
| 2245 | 250 | 250 per year | 1984 on |
| 2251 | 25 | | |
| TOTAL: | 8,625 | | |
| **INACTIVE** | | | |
| 2196 | 500 | | |
| 2246 | 40 | 100 | |
| TOTAL: | 540 | | |

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[1] Measured from the date of this Report

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*CURRENT MARKET DATA*

## URANIUM DEMAND
## (As of 4/30/83)

| Nuexco Project Number | Delivery Period[1] (Thousands of Pounds $U_3O_8$) Within 1 Year | Beyond 1 Year | Remarks |
|---|---|---|---|
| **Inquiries to Purchase: ACTIVE** | | | |
| 1871 | | 250 per year | 1984-86 |
| 1996 | 400 | | |
| 2010 | | 400 per year | 1984-92 |
| 2030 | | 500 | 1985 |
| 2042 | | 400 per year | Long Term |
| 2061 | 25 | | |
| 2114 | | 300 per year | 1984-90 |
| 2115 | 200 | 200 | |
| 2161 | 250 | | $U_3O_8$ or $UF_6$ |
| 2163 | | 400 per year | 1988 on |
| 2167 | 250 | 250 + per year | 1984-99 |
| 2187 | 50 | | |
| 2188 | | 350 per year | 1985 on |
| 2217 | 900 | 500 per year | 1984-95 |
| 2238 | 50 | | Enriched $UF_6$ |
| 2244 | | 350 per year | 1985 on |
| 2269 | 250 | | |
| 2270 | 175 | | |
| TOTAL: | 2,550 | | |
| **INACTIVE** | | | |
| 1459 | | 200 per year | Long Term |
| 1888 | | 400 per year | Long Term |
| 1999 | | 50 per year | 1985-90 |
| 2025 | | 350 | |
| 2209 | 200 | | |
| 2213 | 125 | | $UF_6$ |
| TOTAL: | 325 | | |

[1] Measured from the date of this Report.

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## CONVERSION SUPPLY
## (As of 4/30/83)

| Nuexco Project Number | Delivery Period[1] (Thousands of Pounds U as $UF_6$) | | Remarks |
|---|---|---|---|
| | Within 1 Year | Beyond 1 Year | |
| **ACTIVE** | | | |
| 1609 | 500 | 1,500 per year | Long Term |
| 1840 | 130 | | |
| 1936 | 1,000 | 200 per year | Long Term |
| 2051 | 1,000 | | |
| 2141 | 500 | 500 per year | 1984-85 |
| 2143 | 400 | | |
| 2220 | 400 | | |
| 2222 | 100 | 175 | |
| TOTAL: | 4,030 | | |
| **INACTIVE** | | | |
| 2008 | 800 | 800 | |
| 2181 | 650 | 650 per year | Long Term |
| TOTAL: | 1,450 | | |

## CONVERSION DEMAND
## (As of 4/30/83)

| Nuexco Project Number | Delivery Period[1] (Thousands of Pounds U as $UF_6$) | | Remarks |
|---|---|---|---|
| | Within 1 Year | Beyond 1 Year | |
| **ACTIVE** | | | |
| 2129 | 500 | 500 | |
| 2135 | 135 | 135 per year | 1984-87 |
| 2148 | | 400 per year | 1984-90 |
| 2190 | 300 | 300 per year | 1984 on |
| 2194 | | 500 per year | 1986 on |
| 2199 | 150 | 300 per year | 1985 on |
| TOTAL: | 1,085 | | |
| **INACTIVE** | None | | |

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[1] Measured from the date of this Report.

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*CURRENT MARKET DATA*

## LOAN SUPPLY AND DEMAND
### (As of 4/30/83)

| Nuexco Project Number | Delivery Period[1] (Thousands of Pounds $U_3O_8$) Within 1 Year | Beyond 1 Year | Remarks |
|---|---|---|---|
| **Available for Loan:** | | | |
| **ACTIVE** | | | |
| 1938 | 1,500 | | $UF_6$ |
| 2121 | 600 | | |
| 2128 | 2,500 | | |
| 2204 | 500 | 200 per year | Long Term |
| 2205 | 300 | | |
| TOTAL: | 5,400 | | |
| **INACTIVE** | | | |
| 1815 | 1,000 | | $UF_6$ |
| 1884 | 600 | | |
| 2036 | 500 | | $UF_6$ |
| 2040 | 600 | | $UF_6$ |
| 2133 | 200 | | |
| 2139 | 2,000 | | |
| 2157 | 600 | | |
| TOTAL: | 5,500 | | |
| **Inquiries to Borrow:** | | | |
| **ACTIVE** | | | |
| 1998 | 200 | 200 | |
| 2006 | 600 | | |
| 2070 | 200 | | $UF_6$ |
| 2118 | 250 | | $U_3O_8$ or $UF_6$ |
| 2153 | 300 | | |
| TOTAL: | 1,550 | | |
| **INACTIVE** | None | | |

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[1] Measured from the date of this Report

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*RECENT DEVELOPMENTS*

## AUSTRALIA

The Australian Labor Party (ALP) government has informed uranium companies that the letters of determination that specified negotiating guidelines and formed the basis for contract approval issued by the previous government have lapsed. New guidelines will not be available until the government has decided how the ALP platform on uranium mining will be implemented. It is understood that the withdrawal of negotiating licenses is temporary and new ones may be applied for, but no application has been received by the government so far.

The ALP platform is long and complicated and leaves wide latitude for interpretation. Apparently the proposed projects, Koongarra, Jabiluka and Yeelirrie, cannot proceed. The relevant sentence in the party platform says that an ALP government will "give total commitment to preventing any new mines from being developed during our period in office."

The task of turning the party platform into federal government policy is now in the hands of four ministers assisted by government officials. The four ministers engaged in formulating the new guidelines are the Minister for Trade and Deputy Prime Minister, Mr. Bowen; the Minister for the Environment, Mr. Cohen; Minister for Resources and Energy, Senator Walsh; and the Minister for Aboriginal Affairs, Mr. Holding.

* * *

The ALP decision to withdraw the negotiating licenses (determinations) of uranium companies has drawn criticism from Britain's Central Electricity Generating Board (CEGB). The CEGB claims that it has a "commercial understanding" with Pancontinental for uranium supply from the proposed Jabiluka mine. The CEGB is justifiably concerned that, without the right to negotiate additional contracts, the mine will not proceed. The Minister for Energy and Resources, Senator Walsh, dismissed the CEGB criticism on the grounds that Pancontinental had failed to meet price guidelines last year when the previous government refused to approve the contract between the CEGB and Pancontinental, and that Jabiluka's problems were, therefore, not caused by this government but by the state of the market.

* * *

The Aborigines, traditional owners of the land containing Denison's Koongarra uranium deposit, have taken a decidedly pro-mining posture in recent months. They have instructed the Northern Land Council to negotiate an agreement with Denison. The company claims it can sell the total output from the proposed mine and is about to resolve the foreign requirement (requiring Denison to sell 75 percent equity to Australians) to the satisfaction of the government. However, after discussions initiated by the ALP Minister of Aboriginal Affairs, the traditional owners have now agreed to his request not to sign or initial any agreement with the company until the government has formed its policy on uranium mining. The government hopes to accomplish this task within three months.

* * *

The South Australian Chamber of Mines has attacked the state government's decision to block the developments of two uranium mines, Honeymoon and Beverley, and to oppose the building of an enrichment plant in the state, the prospect of which is being studied by the Uranium Enrichment Group of Australia (UEGA). The Chamber claims that 4 to 5 thousand jobs will be lost to the state through this decision.

UEGA has deferred its plans to conduct an international market survey as a forerunner of its full-scale feasibility study of the enrichment plant project. The plans have been suspended because of the uncertainty of the Labor government's uranium policy. UEGA's decision was taken without consulting the government. Apparently the joint venture partners realized that the government had more pressing priorities than an enrichment project and hope by deferring their plans to gain time for clarification and discussion with the government.

* * *

After twenty-one months of operating experience, with most of the teething troubles behind it, Energy Resources of Australia's (ERA) Ranger mine continues to produce in excess of its rated capacity of 6.6 million pounds $U_3O_8$ per year. Production in the first quarter of 1983 amounted to 1.73 million pounds $U_3O_8$, bringing the output for the last nine months to 5.2 million pounds, equivalent to an annual rate of approximately 7 million pounds $U_3O_8$.

## CANADA

One of the reasons Canadian producers have been so successful in selling uranium over the past several years has been their federal government's pragmatic approach toward export policy. Recently, even though there has

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been no formal change in policy, the government's position on implementation of its so-called "upgrading" policy has changed.

A number of $U_3O_8$ export contracts have been approved in recent years by the Canadian government, even though the preferred form for export is $UF_6$. As *a practical matter*, a buyer that had already purchased conversion services could reasonably expect to contract to purchase $U_3O_8$ (rather than $UF_6$) and could expect that the contract would still receive export approval. The Canadian government had also been willing to make some trade-offs against offset business (agreeing to allow the export of $U_3O_8$ in return for a commitment to convert *other* $U_3O_8$), indicating an awareness of the buyers' problems and a willingness to work out reasonable accommodations.

It is now very unlikely that a new contract to export $U_3O_8$ (i.e., without upgrading to $UF_6$) would be approved. A desire for maximum utilization of the new conversion capacity at Eldorado's Port Hope facility is understandable, but this change could have far-reaching effects on the uranium market.

The majority of unfilled demand worldwide through the end of this decade is in the USA. The Key Lake partners have been very successful in selling into the USA. A number of these sales would not have taken place had the Canadian government insisted on exporting $UF_6$. US utility buyers, on the whole, are not willing to purchase $UF_6$ if they have already contracted for conversion services. This is true, based on Nuexco's experience, even if the economics of the situation would dictate otherwise; $UF_6$ sellers are simply excluded from consideration in many cases.

Canadian government insistence on exporting $UF_6$ would almost immediately shift the competitive advantage to US sellers. With its floor price policy and with the uncertainty surrounding the new Labor government, Australia would not likely gain any competitive edge. However, if South African producers began to pursue US buyers, they could move rapidly ahead of Canadian sellers in the race to fill US unfilled requirements.

It has been rumored for some time that Canadian export policy was under review. While the government is apparently tightening its enforcement of the upgrading policy, it may be preparing to ease other guidelines.

There is some sentiment in Canada that a floor price may no longer be necessary as a government requirement for export. The domestic allocation requirement and foreign ownership limitation may also be eased. None of these changes, including a possible relaxation in pricing guidelines, will outweigh the impact of uncompromising enforcement of upgrading policy.

## SOUTH AFRICA

First quarter 1983 production figures from South African gold-uranium operations are presented in Table 1. Although total production has remained constant when compared with the previous quarter, substantial increases at Blyvooruitzicht, Harmony, St. Helena and Western Areas were largely offset by individual decreases in production at Randfontein, Chemwes and Western Deep Levels.

**Table 1**

**REPUBLIC OF SOUTH AFRICA: URANIUM PRODUCTION FROM GOLD-URANIUM OPERATIONS**
**(Thousands of Pounds $U_3O_8$)**

| Operation | First Quarter 1983 |
|---|---|
| Blyvooruitzicht | 149 |
| Buffelsfontein | 304 |
| CHEMWES | 268 |
| Dreifontein Consolidated | 108 |
| ERGO | 143 |
| Harmony | 366 |
| Hartebeestfontein | 234 |
| J.M.S. | 371 |
| Randfontein | 270 |
| St. Helena (Beisa) | 198 |
| Vaal Reefs | 1,018 |
| Western Areas | 132 |
| Western Deep Levels | 94 |
| TOTAL | 3,654 |

Table 1 includes all of South Africa's uranium producers except for Palabora Mining Company (PMC) which is not a member of the Chamber of Mines. PMC announced $U_3O_8$ sales for first quarter 1983 of 356,000 pounds $U_3O_8$. 1982 production was 569,000 pounds $U_3O_8$, a new production record, which was 10 percent higher than 1981.

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Some specific observations about South Africa's first quarter 1983 uranium production are as follows:

1. Overall Chamber of Mines uranium production of approximately 3.7 million pounds $U_3O_8$ was almost identical to that of the previous quarter.
2. Output at Blyvooruitzicht rose 31 percent over the previous quarter, due to an improved yield.
3. At Chemwes (Stilfontein), production fell 23 percent due to a 19-percent decline in yield and a 7-percent decline in tons treated.
4. Harmony output rose 10 percent, due to a slightly higher yield and tonnage treated.
5. Notwithstanding increased throughput at Randfontein, production was slightly lower due to a lower level of recovery (subsequently improved). Extensions to the uranium section of the Cooke plant are continuing.
6. St. Helena (Beisa) output rose 15 percent due to increased throughput. On April 8, 1983, a methane gas explosion occurred underground, killing 16 employees. Subsequently, 500 black employees terminated their employment. Production will be affected to a limited extent.
7. Western Areas output rose 17 percent due to higher production from the Middle Elsburg Reefs.
8. Production at Western Deep Levels fell 17 percent due to a 15-percent decline in throughput. Nevertheless, announced plans call for 1983 production of 465,000 pounds $U_3O_8$, to be obtained by treating 1,680,000 metric tons at a recovery grade of 0.28 pounds $U_3O_8$ per ton.

* * *

Weak market conditions have for some time hampered marketing efforts by South African producers, making it very difficult for them to sell excess material at prices which would not jeopardize long-term contract renegotiations. However, being by-product producers, they are able to exercise some flexibility in operations in order to mitigate the effects of the weak market. For example, South African producers might:

1. Cease production and meet contract commitments from stockpile. West Rand Consolidated and Blyvooruitzicht are possible candidates.
2. Stockpile production. Vaal Reefs has announced plans to produce approximately 4 million pounds $U_3O_8$ in 1983, of which 43 percent will come from the South Lease area. Present indications are that the company will not be able to sell the entire amount during 1983, so stockpiling is likely.
3. Where applicable, dump uranium-bearing slimes with normal run-of-mine tailings rather than incur the costs of constructing slimes dams to store high-grade uranium streams (i.e., lose uranium rather than stockpile it).
4. Where applicable, save costs by treating only slimes arising from current operations, choosing not to process the contents of existing slimes dams.
5. Save on operating costs by recovering less efficiently, e.g., by using less acid, manganese dioxide, resins, and other reagents in the extraction process.

## UNITED STATES

The US producer segment is characterized by two sharply contrasting trends. On the one hand, numerous formerly prominent uranium producers are liquidating their reserves and holdings in the industry. This trend has been underway for two years or more. In recent months, however, a few producers and potential producers have begun aggressively seeking new reserves, production facilities and joint ventures. Those companies most active in leaving the industry tend to be characterized by association with large corporations, whereas the more aggressive group is comprised of smaller firms. Whether by design or by accident, it appears the surviving US producers can be characterized as having a high degree of corporate flexibility and creativity. If those characteristics carry over into their marketing activities, it would not be surprising to see some innovative marketing techniques appear in the marketplace in the near future.

* * *

From a regulatory or legal perspective, a recent decision of the US Supreme Court has caused considerable excitement, not so much for its content, but due to the manner in which the decision was reported in the media. While the decision is legally interesting, it will have little effect on the nuclear fuel market.

In 1976, California passed a law which said no new nuclear plants could be constructed until the federal government finds a way to dispose of spent fuel. Specifically, the law imposed a moratorium on certification of new nuclear power plants until the state's Energy Commission "finds that there has been developed and that the United States through its authorized agency has approved and there exists a demonstrated technology or means for the disposal of high-level

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nuclear waste." Six other states have passed similar laws.

Pacific Gas and Electric (PG&E) and Southern California Edison sought to have the law overturned as an unconstitutional infringement on the power of the US government to regulate nuclear safety. The Supreme Court of the United States upheld the California law (and ruled against PG&E and Southern California Edison), saying the state of California had the authority to ban further nuclear development for economic reasons. The theory is that if there was no spent fuel storage, then the reactor might have to shut down, thereby disrupting electric service.

This ruling applies directly to the six states having laws similar to the California law: Connecticut, Maine, Maryland, Montana, Oregon and Wisconsin. The ruling does not affect operating nuclear power plants or those presently under construction; it is only units to be ordered or yet to receive construction permits which could be stalled. There are no such units in the seven affected states. (In 1982, Portland General Electric withdrew its construction permit request for the two Pebble Springs units.)

In fact, the only units in the United States ordered, but not yet under construction, are not likely to be built in this century. Thus, there will probably be no practical effect. Only new reactors are affected and no one in the US is close to ordering a new nuclear unit.

Ultimately, this decision could prove positive for nuclear power in that it may force the US government to move forward faster on its spent fuel waste disposal program, in order to assure the viability of nuclear power in the future.

Some pertinent aspects of the opinion are summarized below.

1. The court said that if the aim of the law was to regulate safety, then the law would, in fact, be unconstitutional.

2. In its opinion, the court supported the right of states to determine their "need for power facilities, their economic feasibility and rates and services" and held that the California statute was not adopted to provide protection against radiation hazards.

3. The court emphasized "that the [California] statute does not seek to regulate the construction or operation of a nuclear power plant. It would clearly be impermissible for California to attempt to do so... A state moratorium on nuclear construction grounded in safety concerns falls squarely within the prohibited field" occupied by the federal government.

4. The 97th Congress passed the Nuclear Waste Policy Act of 1982. The bill authorizes repositories for disposal of high-level radioactive waste and spent nuclear fuel. The Supreme Court noted that "while the passage of this act may convince state authorities [of] the federal [government's] commitment to fuel storage and waste disposal," thus allowing nuclear licensing to resume, "it does not appear Congress intended to make that decision for the states through this legislation."

5. The Supreme Court ended its opinion by stating "there is little doubt that the primary purpose of the Atomic Energy Act was, and continues to be, the promotion of nuclear power." In the past, both the House and Senate have "confirmed it was 'a major policy goal of the United States' that the involvement of private industry would 'speed the further development of the peaceful uses of atomic energy'." California has exercised its authority to determine, as a matter of economics, whether nuclear plants should be built. In the Court's opinion, "it is for Congress to rethink the division of regulatory authority in light of its possible exercise by the states to undercut a federal objective. The courts should not assume the role which our system assigns to Congress."

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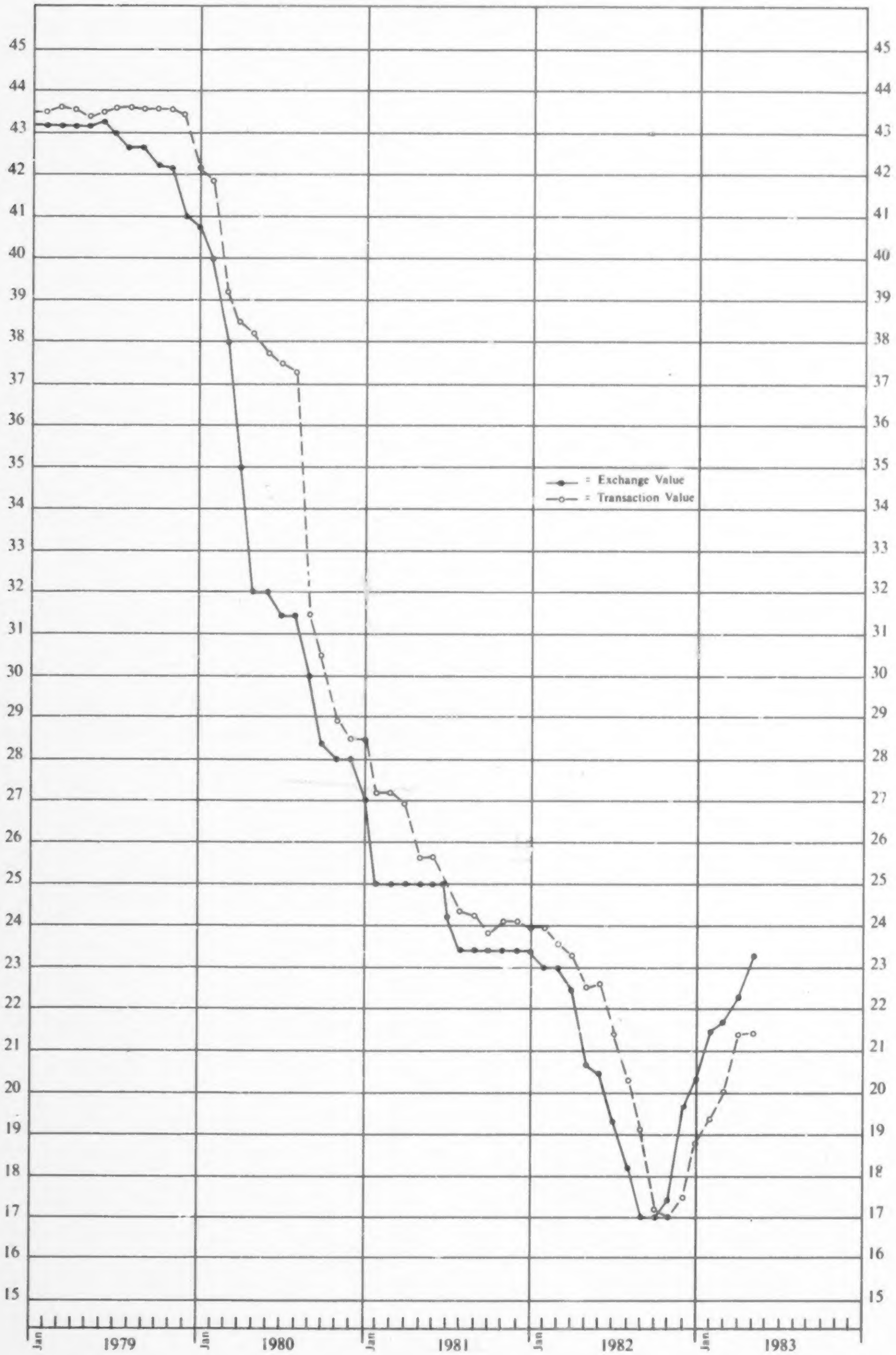
*HISTORICAL MARKET DATA*

## EXCHANGE AND TRANSACTION VALUES
## SINCE JANUARY 1979

Determined as of the last day of the month indicated



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*HISTORICAL MARKET DATA*

## HISTORICAL EXCHANGE VALUES

Determined as of the last day of the month indicated (US Dollars/lb. $U_3O_8$)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1968 | — | — | — | — | — | — | — | 6.35 | 6.35 | 6.40 | 6.45 | 6.50 |
| 1969 | — | 6.35 | 6.10 | 6.10 | 6.25 | 6.25 | 6.20 | 6.20 | 6.15 | 6.15 | 6.15 | 6.20 |
| 1970 | 6.30 | 6.30 | 6.30 | 6.30 | 6.30 | 6.30 | 6.30 | 6.20 | 6.15 | 6.15 | 6.15 | 6.15 |
| 1971 | 6.20 | 6.20 | 6.20 | 6.20 | 6.15 | 6.05 | 6.00 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 |
| 1972 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 |
| 1973 | 5.95 | 6.00 | 6.10 | 6.20 | 6.45 | 6.50 | 6.50 | 6.50 | 6.50 | 6.50 | 6.75 | 7.00 |
| 1974 | 7.70 | 7.90 | 8.00 | 9.00 | 9.50 | 10.50 | 11.50 | 12.00 | 12.50 | 14.00 | 14.75 | 15.00 |
| 1975 | 16.00 | 16.00 | 18.00 | 20.00 | 21.00 | 23.00 | 24.70 | 26.00 | 26.00 | 28.50 | 30.00 | 35.00 |
| 1976 | 35.20 | 37.00 | 39.25 | 40.00 | 40.00 | 40.00 | 40.00 | 40.40 | 41.00 | 41.00 | 41.50 | 41.00 |
| 1977 | 41.35 | 41.50 | 41.60 | 41.60 | 42.00 | 42.25 | 42.25 | 42.25 | 42.40 | 42.75 | 43.20 | 43.20 |
| 1978 | 42.90 | 43.25 | 43.25 | 43.25 | 43.40 | 43.40 | 43.40 | 43.10 | 43.25 | 43.00 | 43.25 | 43.25 |
| 1979 | 43.25 | 43.25 | 43.25 | 43.25 | 43.25 | 43.00 | 42.70 | 42.70 | 42.20 | 42.20 | 41.00 | 40.75 |
| 1980 | 40.00 | 38.00 | 35.00 | 32.00 | 32.00 | 31.50 | 31.50 | 30.00 | 28.50 | 28.00 | 28.00 | 27.00 |
| 1981 | 25.00 | 25.00 | 25.00 | 25.00 | 25.00 | 24.25 | 23.50 | 23.50 | 23.50 | 23.50 | 23.50 | 23.50 |
| 1982 | 23.00 | 23.00 | 22.50 | 20.75 | 20.50 | 19.25 | 18.25 | 17.00 | 17.00 | 17.50 | 19.75 | 20.25 |
| 1983 | 21.50 | 21.75 | 22.25 | **23.25** | | | | | | | | |

## HISTORICAL TRANSACTION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. $U_3O_8$)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1976 | — | — | — | — | 39.60 | 39.70 | 39.70 | 40.40 | 40.30 | 40.60 | 40.70 | 40.70 |
| 1977 | 41.30 | 41.30 | 41.40 | 41.50 | 42.80 | 42.90 | 43.00 | 42.60 | 42.50 | 42.80 | 42.90 | 42.90 |
| 1978 | 43.10 | 43.30 | 43.70 | 43.60 | 43.60 | 43.20 | 43.30 | 43.40 | 43.40 | 43.60 | 43.40 | 43.70 |
| 1979 | 43.60 | 43.80 | 43.70 | 43.40 | 43.60 | 43.70 | 43.70 | 43.60 | 43.60 | 43.60 | 43.50 | 42.30 |
| 1980 | 42.00 | 39.30 | 38.60 | 38.40 | 37.90 | 37.60 | 37.30 | 31.60 | 30.60 | 29.00 | 28.70 | 27.70 |
| 1981 | 27.20 | 27.20 | 27.00 | 25.70 | 25.70 | 24.50 | 24.40 | 24.30 | 23.90 | 24.10 | 24.10 | 24.00 |
| 1982 | 24.00 | 23.70 | 23.40 | 22.60 | 22.70 | 21.50 | 20.30 | 19.10 | 17.30 | 17.00 | 17.55 | 18.80 |
| 1983 | 19.35 | 20.00 | 21.35 | **21.40** | | | | | | | | |

## HISTORICAL CONVERSION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. $U_6$)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1981 | 1.20 | 1.20 | 1.20 | 1.40 | 1.15 | 1.15 | 1.15 | 1.10 | 1.10 | 1.10 | 1.20 | 1.20 |
| 1982 | 1.20 | 1.20 | 1.20 | 1.20 | 1.00 | 1.00 | 1.00 | 0.90 | 1.10 | 1.60 | 1.45 | 1.45 |
| 1983 | 1.20 | 1.40 | 1.40 | **1.20** | | | | | | | | |

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## AUSTRALIA

| | Price Index of Materials Used in Manufacturing Industry—All Groups (Year 1968-69 = 100.0)[1] | Award Rates of Pay Indexes Australia—Adult Males In Mining Wage Earners, Weekly Rates (Year 1976 = 100.0)[2] |
|---|---|---|
| Annual Avg. 1972[3] | 105.6 | 71.26 |
| Annual Avg. 1973[3] | 124.4 | 78.96 |
| Annual Avg. 1974[3] | 141.9 | 108.07 |
| Annual Avg. 1975[3] | 150.4 | 132.55 |
| Annual Avg. 1976[3] | 168.4 | 160.93 |
| Annual Avg. 1977[3] | 192.0 | 179.03 |
| Annual Avg. 1978[3] | 198.5 | 190.04 |
| Annual Avg. 1979 | 248.8 | 196.34 |
| Annual Avg. 1980 | 321.8 | 218.00 |
| Annual Avg. 1981 | 355.3 | 237.34 |
| Annual Avg. 1982 | 367.9 | — |
| Nov 1981 | 351.3 | 157.6[2] |
| Dec 1981 | 349.9 | 167.6[2] |
| Jan 1982 | 354.9 | 169.5[2] |
| Feb 1982 | 356.7 | 171.1[2] |
| Mar 1932 | 360.3 | 171.5[2] |
| Apr 1982 | 367.7 | 171.5[2] |
| May 1982 | 367.6 | 172.0[2] |
| Jun 1982 | 367.2 | 173.2[2] |
| Jul 1982 | 369.1 | 177.3[2] |
| Aug 1982 | 371.5 | 178.2[2] |
| Sep 1982 | 374.0 | 178.3[2] |
| Oct 1982 | 377.2 | 178.4[2] |
| Nov 1982 | 374.5 | 178.5[2] |
| Dec 1982 | 373.7R | 179.5[2] |
| Jan 1983 | 386.5P | 179.2[2] |

P = Preliminary R = Revised since last month

[1] Australian Bureau of Statistics, Canberra: "Price Index of Materials Used in Manufacturing Industry" (Catalogue No. 6411.0), Table 3.

[2] Australian Bureau of Statistics, Canberra: "Award Rates of Pay Indexes, Australia" (Catalogue No. 6312.0), Table 8. Figures are being converted to an Index number. As the data are converted, the new index numbers will be inserted. Figures for the latest fourteen months shown are subject to revision.

[3] Monthly data for 1970 through 1978 appear on pages 4.7 and 4.8 of Nuexco Report 138.

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*GOVERNMENT STATISTICS*

## CANADA

| | Industry Selling Price Index: Manufacturing (D 500000)[1] [2] (1971 = 100.0) | Wage-earner Data: Average Hourly Earnings (C$)[4] [5] | | |
|---|---|---|---|---|
| | | Metal Mining, including Milling (SIC 050-099)[3] | Primary Metal Industries, non-ferrous (SIC 296-298) | Chemicals and Chemical Products (SIC 370-379) |
| Annual Avg. 1978 | 190.4 | 8.75 | 6.82 | 6.97 |
| Annual Avg. 1979 | 217.9 | 9.66 | 7.35 | 7.67 |
| Annual Avg. 1980 | 247.2 | 10.80 | 8.05 | 8.50 |
| Annual Avg. 1981 | 288.7 | 12.23 | 9.03 | 9.53 |
| Jan 1982 | 281.9 | 13.49 | 9.53 | 10.11 |
| Feb 1982 | 283.5 | 13.61 | 9.60 | 10.19 |
| Mar 1982 | 284.8 | 13.74 | 9.62 | 10.35 |
| Apr 1982 | 287.7 | 13.81 | 9.79 | 10.48 |
| May 1982 | 288.8 | 13.86 | 9.88 | 10.62 |
| Jun 1982 | 289.7 | 13.83 | 9.92 | 10.69 |
| Jul 1982 | 290.3 | 14.02 | 10.05 | 10.73 |
| Aug 1982 | 290.3 | 14.23 | 10.03 | 10.80 |
| Sep 1982 | 292.4R | 14.01 | 10.18 | 10.73 |
| Oct 1982 | 292.1R | 13.88 | 10.18 | 10.86 |
| Nov 1982 | 291.3R | 14.27R | 10.43 | 10.90 |
| Dec 1982 | 292.3 | 14.40R | 10.59R | 11.08P |
| Jan 1983 | 292.6R | 14.39P | 10.69P | 11.03P |
| Feb 1983 | 293.4R | — | — | — |
| Mar 1983 | 295.6 | — | — | — |

P = Preliminary R = Revised since last month

[1] Statistics Canada, Prices Division, Ottawa: "Industry Price Indexes" (Catalogue 62-011), Table 1. Indexes for the most recent six months shown are subject to revision.

[2] Monthly data for 1973 through 1978 appear on page 4.10 of Nuexco Report 138.

[3] The wage earner series in Nuexco reports prior to March 1983 was Metals (SIC 050-059).

[4] Statistics Canada, Labour Division, Employment and Payrolls Section, Ottawa: "Employment, Earnings and Hours" (Catalogue 72-002), Table 2.

[5] Monthly data for 1977 and 1978 appear on page 4.11 of Nuexco Report 138.

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## REPUBLIC OF SOUTH AFRICA

| | Average Declared Working Costs per Metric Ton of Gold Ore Milled (Rand)[1] | Consumer Price Index[2] (1975 = 100, except where otherwise indicated) | Producer[5] Price Index All Groups (1975 = 100) | Total Employment in Mining and Quarrying (Code 35)[7] | Total Salaries and Wages in Mining and Quarrying (1,000 Rand) (Code 40)[7] |
|---|---|---|---|---|---|
| Annual Avg. 1971[3] | 7.88 | 106.4[4] | 59.1 | 652,294 | 415,956 |
| Annual Avg. 1972[3] | 8.79 | 113.3[4] | 63.9 | 623,067 | 443,933 |
| Annual Avg. 1973[3] | 10.51 | 124.1[4] | 72.3 | 684,743 | 572,133 |
| Annual Avg. 1974[3] | 13.18 | 138.5[4] | 85.3 | 674,140 | 761,596 |
| Annual Avg. 1975[3] | 16.71 | 157.2[4] | 100.0 | 639,473 | 1,003,617 |
| Annual Avg. 1976[3] | 19.30 | 174.7[4] | 115.1 | 671,240 | 1,212,983 |
| Annual Avg. 1977[3] [6] | 23.87 | 194.4[4] | 130.0 | 712,006 | 1,420,670 |
| Annual Avg. 1978[3] [6] | 27.14 | 137.2 | 142.7 | 664,571 | 1,537,169 |
| Annual Avg. 1979[3] [6] | 30.18 | 155.3 | 164.5 | 692,209 | 1,830,632 |
| Annual Avg. 1980[6] | 35.53 | 176.7 | 192.1 | 714,379 | 2,279,615 |
| Annual Avg. 1981 | 41.89 | 206.5 | 218.3 | 728,506 | 2,820,505 |
| Oct 1981 | — | 213.4 | 227.0 | 717,918 | 248,159 |
| Nov 1981 | — | 214.8 | 229.4 | 720,255 | 253,044 |
| Dec 1981 | 44.52 | 216.3 | 230.4 | 709,612 | 257,655 |
| Jan 1982 | — | 217.6 | 233.1 | 700,375 | 257,173 |
| Feb 1982 | — | 220.2 | 236.8 | 705,992 | 250,191 |
| Mar 1982 | 45.49 | 225.2 | 237.4 | 725,700 | 262,210 |
| Apr 1982 | — | 228.9 | 241.9 | 707,502 | 252,562 |
| May 1982 | — | 230.3 | 244.8 | 715,162 | 258,770 |
| Jun 1982 | 45.77 | 232.1 | 246.7 | 707,552 | 261,361 |
| Jul 1982 | — | 234.1 | 249.4 | 702,141 | 283,248 |
| Aug 1982 | — | 236.8 | 253.4 | 705,562 | 276,730 |
| Sep 1982 | 48.04 | 241.0 | 255.0 | 704,344 | 282,782 |
| Oct 1982 | — | 243.9 | 260.1 | 701,316 | 285,328 |
| Nov 1982 | — | 245.4 | 262.5 | 707,966 | 287,699 |
| Dec 1982 | 49.62 | 246.2 | 263.0 | 683,982 | 288,019 |
| Jan 1983 | — | 249.0 | 264.9 | — | — |
| Feb 1983 | — | 253.1 | 267.4 | — | — |
| Mar 1983 | — | 255.9 | — | — | — |

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[1] Chamber of Mines of South Africa, Johannesburg; "Analysis of Working Results," published quarterly.
[2] Republic of South Africa Department of Statistics, Pretoria; "Government Gazette: Consumer Price Index for Urban Areas."
[3] Historical data for the Average Declared Working Costs and Consumer Price Index 1970-1979 appear on page 4.9 of Nuexco Report 140.
[4] April 1970 = 100.00.
[5] Previously known as the WHOLESALE PRICE INDEX, now the PRODUCER PRICE INDEX. The computation remains the same.
[6] Historical data for Codes 35 and 40 1977-1980 appear on page 28 of Nuexco Report 157.
[7] Bulletin of Statistics, Department of Statistics, Pretoria.

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*GOVERNMENT STATISTICS*

## UNITED STATES

| | Producer Price Index— Industrial Commodities (1967 = 100)[1] | Producer Price Index— All Commodities (1967 = 100)[1] | Consumer Price Index (1967 = 100)[2] | GNP Implicit Price Deflator (1972 = 100)[3] | Gross Average Hourly Earnings of Production or Non-supervisory Workers (US$)[4] | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Metal Mining (SIC 10) | Primary Non-ferrous Metals (SIC 333) | Chemicals and Allied Products (SIC 28) | Electric and Electronic Equipment (SIC 36) |
| Annual Avg. 1972[5] | 117.9 | 119.1 | 125.3 | 100.00 | 4.56 | 4.59 | 4.26 | 3.71 |
| Annual Avg. 1973[5] | 125.9 | 134.7 | 133.1 | 105.75 | 4.84 | 4.98 | 4.51 | 3.91 |
| Annual Avg. 1974[5] | 153.8 | 160.1 | 147.7 | 115.08 | 5.44 | 5.63 | 4.88 | 4.21 |
| Annual Avg. 1975[5] | 171.5 | 174.9 | 161.2 | 125.79 | 6.13 | 6.24 | 5.39 | 4.64 |
| Annual Avg. 1976[5] | 182.4 | 183.0 | 170.5 | 132.34 | 6.76 | 6.87 | 5.91 | 4.96 |
| Annual Avg. 1977[5] | 195.1 | 194.2 | 181.5 | 140.05 | 7.28 | 7.67 | 6.43 | 5.39 |
| Annual Avg. 1978[5] | 209.4 | 209.3 | 195.4 | 150.42 | 8.23 | 8.56 | 7.02 | 5.82 |
| Annual Avg. 1979[5] | 236.5 | 235.6 | 217.4 | 163.42 | 9.27 | 9.50 | 7.60 | 6.32 |
| Annual Avg. 1980[5] | 274.8 | 268.8 | 246.8 | 178.64 | 10.26 | 10.63 | 8.30 | 6.94 |
| Annual Avg. 1981 | 304.1 | 293.4 | 272.4 | 195.51 | 11.55 | 11.98 | 9.12 | 7.62 |
| Annual Avg. 1982 | 312.3P | 299.3P | 289.1 | 207.15 | 12.31 | 12.90 | 9.98 | 8.17 |
| Mar 1982 | 311.0 | 298.0 | 283.1 | 203.68 | 12.29 | 12.69 | 9.71 | 8.01 |
| Apr 1982 | 309.9 | 298.0 | 284.3 | — | 12.23 | 12.68 | 9.81 | 8.03 |
| May 1982 | 309.6 | 298.6 | 287.1 | — | 12.25 | 12.71 | 9.83 | 8.05 |
| Jun 1982 | 310.6 | 299.3 | 290.6 | 205.98 | 12.26 | 12.91 | 9.95 | 8.09 |
| Jul 1982 | 312.8 | 300.4 | 292.2 | — | 12.23 | 12.91 | 10.02 | 8.18 |
| Aug 1982 | 313.2 | 300.2 | 292.8 | — | 12.29 | 12.97 | 10.03 | 8.24 |
| Sep 1982 | 312.7 | 299.3 | 293.3 | 208.51 | 12.53 | 13.46 | 10.20 | 8.31 |
| Oct 1982 | 314.3 | 299.8 | 294.1 | — | 12.50 | 13.22 | 10.24 | 8.34 |
| Nov 1982 | 315.0R | 300.3R | 293.6 | — | 12.52 | 13.18 | 10.28 | 8.38 |
| Dec 1982 | 315.0P | 300.6P | 292.4 | 210.42 | 12.52 | 13.01 | 10.34 | 8.45 |
| Jan 1983 | 314.0P | 300.0P | 293.1 | — | 12.62R | 13.29 | 10.35 | 8.48R |
| Feb 1983 | 314.4P | 301.2P | 293.2 | — | 12.65P | 13.22P | 10.44P | 8.52R |
| Mar 1983 | 313.4P | 300.5P | 293.4 | 213.41P | — | — | 10.44P | 8.51P |

P = Preliminary R = Revised since last month

[1] US Bureau of Labor Statistics, Washington, D.C.; "Producer Prices and Price Indexes," Table 6 (formerly "Wholesale Prices and Price Indexes"). Producer Price Indexes are revised four months after they are first released to reflect the availability of late reports and corrections by respondents.

[2] US Bureau of Labor Statistics, Washington, D.C.; Consumer Price Index for All Urban Consumers, US City Average, All Items.

[3] US Department of Commerce, Washington, D.C.; Bureau of Economic Analysis, National Income and Wealth Division; "Survey of Current Business," Table A. The GNP Implicit Price Deflator is published quarterly, and seasonally adjusted.

[4] US Bureau of Labor Statistics, Washington, D.C.; "Employment and Earnings," Table C-2. All data based on 1972 revision of SIC Manual. Data for 1970-1976 are adjusted to the March 1977 benchmark. Data for 1977-1978 are adjusted to the March 1979 benchmark. Data for January 1979 and beyond are adjusted to the March 1980 benchmark.

[5] Monthly data 1970-1978 for Producer Price Index-Industrial Commodities, Consumer Price Index, and Employment and Earnings SIC codes 10, 333, and 28, and quarterly data for GNP Implicit Price Deflator appear on pages 4.6-4.8 of Nuexco Report 139.
Monthly data 1977-1978 for Employment and Earnings SIC Codes 10, 333, and 28 appear on page 33 of Nuexco Report 147.
Monthly data 1970-1978 for Employment and Earnings SIC Code 36 appear on page 23 of Nuexco Report 154.
Monthly data 1979-1980 for Employment and Earnings, Revised Establishment Data, all listed codes, appear on page 22 of Nuexco Report 158.
Monthly data 1977-1980 for Producer Price Index-All Commodities, appear on page 21 of Nuexco Report 158.

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# The AUSTRALIAN URANIUM SITUATION: REALITY OR MIRAGE?

By

**Peter R. Stork**
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Presented To:

**Annual Petroleum & Mineral Review Conference**

Sponsored by
Academy of Science
Canberra, A.C.T., Australia
March 23, 1983

# THE AUSTRALIAN URANIUM SITUATION: REALITY OR MIRAGE?

By: Peter R. Stork
Oratom Consulting Pty., Ltd.

## Introduction

It is my privilege to present the paper on the uranium market at this year's Petroleum and Mineral Review Conference. My talk will be concerned with the projection of market changes as they arise from the interaction of nuclear power growth, uranium production economics, inventories and new ways of utility thinking.

The paper has three main parts. The first offers a retrospective look at the present condition of the uranium market and how it has come about. The second provides an outlook for the behavior of the market to 1996, as it appears plausible from current knowledge. The third part discusses briefly the chief implications for the Australian uranium industry, as I see them.

This paper is based on one of the most extensive data bases on the commercial nuclear industry in existence today, but it also contains personal judgment. Because human knowledge, particularly of the future, is quite imperfect, my views must remain open to re-interpretation as and when new evidence comes to light.

The uranium industry has been for some time in the process of change. The steep growth path predicted only a few years ago did not materialize. Indeed, the slow growth of nuclear generating capacity has reduced expected as well as real uranium demand, exacerbating the traditional excess of supply over consumption.

In addition, the nuclear power program is still experiencing attrition. Since 1975, eighty nuclear units have been cancelled in the USA. Cancellations amounted to 23 GWe in 1982, representing one-fifth of the US nuclear capacity projected for 1990. Completion of new nuclear power stations takes place much slower than expected. Of the 189 plants under construction and one order today, 158 are delayed and 30 have been indefinitely deferred. The combined effect of these factors has led to larger and larger inventories. Uranium stocks today have reached approximately 440 million pounds $U_3O_8$, representing more than 5 years of forward consumption.

Rising interest rates, inflation, falling electricity demand, and extended nuclear construction schedules have caused financial strain for the utility industry worldwide. To alleviate the pressure, utilities began to sell surplus inventories and deferred longer-term uranium purchasing decisions. Despite the chilly environment, world nuclear power capacity is anticipated to grow at a rate of 5 to 6 percent per year, mainly as a result of the construction backlog from orders placed several years ago.

The traditional industry practice of purchasing uranium supplies under long-term contracts has caused market saturation well ahead of delivery dates. Uranium requirements for the years 1987, 1990 and 1996 are estimated to be already under contract to the extent of 70 percent, 62 percent, and 40 percent, respectively. The available market is represented by the remainder.

## Nuclear Power Growth

Figures 1 and 2 represent Nuexco's latest published forecast of nuclear power growth for the world outside communist areas (WOCA). Nuclear generating capacity will increase from 146 GWe in 1982 to 370 GWe in 1996, representing a growth rate of 5.8 percent per year from 1984. Installation of nuclear capacity is not anticipated to occur at the same rate everywhere. There are distinct regional differences.

In the USA, the nuclear capacity will reach a plateau, as no sustained growth is expected to occur. Even if utilities were to place new plant orders by 1984-85, they would not affect the forecast because of the ongoing attrition through cancellation of nuclear power stations and their long lead times of 12 years or more.

The European nuclear program is expected to increase by a factor of 2.2, and Far East capacity may grow by a factor of 2.6. Overall, Nuexco foresees a doubling of capacity by 1996 from 1984 levels.

In developing a picture of the uranium market, the increase in nuclear power generating capacity over time is only one factor among many. Its growth rate of almost 6 percent per year is deceptively high. Taken by itself, it could lead to overoptimistic assumptions unless circumscribed by the other factors.

## Reactor Delays and Deferrals

When comparing published latest estimates (December 1982) of commercial operating dates (COD) of the 189 nuclear power stations under construction and on order with the enrichment service contracts for the same units, wide discrepancies have been observed. Thus, the published completion dates require serious further revision. On average, published completion dates will suffer a delay of at least 2 years. In Europe and the Far East the average delay is 1.5 years per unit; in North America, 2.5 years per unit. Thirty nuclear plants are

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considered as indefinitely deferred, of which 10 are located in Europe and 19 in North America.

**Uranium Consumption**

Estimates of future uranium consumption follow from the nuclear capacity forecasts, taking into account nuclear plant and fuel characteristics as well as fuel cycle requirements. Consumption is defined as the amount of uranium a power plant needs in the fuel cycle pipeline to run its reactor for one year. Consumption is therefore not to be equated with demand in market terms.

Uranium consumption is estimated to double during the forecast period, growing from 63 million pounds in 1982 to 128 million pounds of $U_3O_8$ in 1996. Figure 3 and 4 show details. The estimated growth rate is 3.4 percent per year from 1984. In the USA, consumption will be largely stagnant from 1984 onwards, averaging 35 million pounds of $U_3O_8$ per year. In contrast, Europe shows an increase of 63 percent. The consumption in the Far East is estimated to double over the period. Worldwide consumption is likely to increase by slightly more than 50 percent over the next 13 years.

**Uranium Production**

The bulk of world uranium supply is produced in seven major producing regions: Australia (holding the largest known uranium resources), Canada, Central Africa, France, Namibia, South Africa and the USA. In the early history of uranium mining, uranium was produced from small mines with only several hundred thousand pounds of yearly capacity or as a by-product from gold-mining operations. Since the discovery of large deposits in Namibia, Canada and Australia, the uranium supply industry has been undergoing significant changes towards maturity. Progressively, small, higher-cost producers are being displaced by those who can offer substantial economies of scale from large operations. Reduced demand for uranium is accelerating the process. As a result, it is expected that mine closures in the USA will reduce US production by about 50 percent, Central Africa's production may be curtailed by 30 percent, and projects in Australia and Canada will be deferred or even cancelled. Consequently, worldwide uranium production will fall from 112 million pounds in 1982 to 95 million pounds in 1994, stabilizing between 100 and 106 million pounds per year from 1985 onwards. Because Australian and Canadian production are no longer considered essential for the supply of future uranium demand, contrary to the view which had prevailed as recently as 1979, only producers who can effectively displace production elsewhere will enter the market or expand. Figures 5 and 6 provide details of Nuexco's forecast of uranium production to 1996. Three observations may help to clarify this forecast.

1. Canadian production will expand at Elliot Lake and Key Lake, but operations in Eastern Canada are assumed to decline from 1990 onwards.
2. Market shares between most major producing regions remain more or less constant because many operations must be regarded as "captive" to consumers.
3. Competition between Australia and Canada is assumed to be resolved in Canada's favor until 1990, due to Canada's proximity to the US market, where most of the unfilled demand will occur during the 1980s.

Figures 5 and 6 illustrate that uranium production is not a fast-growing industry; in fact, investors are withdrawing, as the decisions of several major oil companies have recently shown. Aware of these changes, producers are concerned, although their perceptions differ.

1. US producers believe that they will be displaced by lower-cost producers from Canada and Australia.
2. West Canadian companies and their Australian counterparts who seek to initiate projects fear that continuing low prices will preclude market entry or the recovery of investment costs.
3. Australian producers are concerned that they will be left without adequate government policy support in an increasingly competitive market.
4. Some producers are concerned about the inventories held by national entities with weak nuclear programs, as this surplus may be offered in the market at depressed prices.
5. Many producers are concerned about the risk of their long-term prices becoming tied to the spot price, which may display even more volatile behavior in the future. This maturing process, wherein high-cost operations are phased out and replaced by large lower-cost operations, brings about new shifts of buyer attention, initially towards Canada and later in favor of Australia.

During this transition, production will continue to exceed consumption and the buildup of inventories will persist. Uranium surplus stocks will continue to be redistributed through the secondary market until the majority of users are content with their individual positions. The secondary market will partly suppress the need of users to enter into long-term supply contracts. Once redistribution has occurred, uranium users will return to their traditional method of purchasing ura-

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nium through long-term contracts with primary producers. Consumers run the risk, however, that at that time insufficient production capacity may be available to meet their needs.

**Uranium Inventories**

The long-term mismatch of consumption with production has resulted in large uranium stocks in the hands of consumers and producers. Total world inventories in all stages of the fuel cycle are estimated to contain the equivalent of 440 million pounds of $U_3O_8$. Because existing supply contracts make it imperative for users to purchase uranium in excess of consumption, inventories are expected to grow until 1988, and only then decline slowly. Figure 7 shows the forecast of world inventories to 1996. The two nations with the largest inventories are France and Japan, who together hold one-third of the world inventory today.

Figure 7 also identifies the level of desirable inventory holdings, taking into account that the criteria for what is desirable vary from country to country. By assumption, these have been taken for the US at 1.5 years of consumption; 3 years for Europe; 5 years for the Far East; and 3 years for "other nations." Whilst inventories in the US are expected to fall, most of the excess inventories will accumulate outside the US.

As a measure of size, the total quantity of uranium stocks is not a valid yardstick. Only when inventories are expressed as a ratio of estimated consumption (relative inventory) are they seen in perspective. Figure 8 depicts relative inventories over the forecast period. Total free world (WOCA) inventories are estimated to fall from 5 years forward consumption in 1982 to 3.5 years of consumption in 1996. Large excess inventories affect the market in two ways: by tempering the propensity of utilities to enter into long-term contracts, and by destablizing prices. Information on inventory build-up and redistribution, if monitored effectively, may provide the industry with an additional tool to assess "real" as distinct from "perceived" uranium demand.

**Unfilled Requirements**

Unfilled requirements are the quantities of uranium needed by utilities for consumption which have not yet been purchased. The forecast for unfilled requirements between 1987 and 1996 is shown in Figure 9. The aggregate quantity amounts to 390 million pounds of $U_3O_8$, which constitutes the total available market over the period. Until 1990, the US requirement will dominate in the market, while unfilled requirements outside the US are expected to grow slower on account of higher market saturation existing in Europe and the Far East. In 1990, total unfilled requirements are equally divided between US and non-US utilities, but from then on US requirements will decline in dominance compared with the faster growing market outside the USA.

If utilities were to cover from excess inventories all of the 1987 unfilled requirements of 20 million pounds, the surplus at that time would be reduced by a mere 10 percent. In addition, a large portion of existing production capacity is awaiting future commitment. It is, therefore, not unduly pessimistic to project world oversupply conditions to 1990 at least. Unfilled requirements may be filled from a mix of three sources:

1. inventories;
2. existing, uncommitted capacity;
3. new capacity.

As domestic production is declining in the USA, but unfilled requirements are increasing, US utilities will rely to a larger degree on foreign sources, buying initially from Canada and later, assuming some reassuring experiences, increasingly from Australia.

**Supply and Consumption**

Existing production capacity, including its uncommitted portion, is inadequate to meet uranium consumption from 1988 onwards. To satisfy requirements, uranium consumers will rely on two sources of supply for the balance: inventories and new projects. Figure 12 expresses Nuexco's estimate of how these three sources satisfy consumption needs. The graph may engender a mild optimism regarding future market opportunities, but one must remain mindful of the fact that an excess inventory of 220 million pounds of $U_3O_8$ overshadows the market during the forecast period.

**Implications for the Australian Industry**

The uranium market on its journey to maturity is moving towards a new equilibrium. To reach it, production must fall sufficiently below consumption to draw down inventories. This adjustment causes stress for individual producers. Those who only marginally recover their cost at current prices are threatened. Those who wish to add substantial capacity may face long deferrals depending on their position on the supply curve. The tension will be resolved by the market. Unfilled requirements will operate as the driving variable in the process of price determination. What are the consequences for the Australian uranium industry? Several large projects are in an advanced stage of

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technical readiness. As has been demonstrated, the market is not large enough over the next 5 to 7 years to accommodate them all at the same time. Their individual opportunities are determined by:

1. The economic viability of each project under current market conditions;
2. Their visibility in the marketplace as valid, alternate sources of supply;
3. The decision of consumers to entrust long-term supply to an Australian producer.

Inventory redistribution apart, Australian producers face strong competition from Canada and South Africa for a share of the relatively small market constituted by the unfilled requirements. Nevertheless, opportunities for Australian suppliers exist simply because not every utility wishes to rely too heavily on these two sources alone, provided all other considerations are equal. Eventually, those producers with the highest customer appeal in terms of price, government commitment, political stability, foreign equity, delivery schedule and production economics will make the grade.

Although opportunities for launching a major project before 1990 have become more remote, projects whose start-up was planned for the 1988-1990 time slot should continue to maintain economic vigilance by adjusting their projects to the market and by keeping user awareness high. Consumer confidence, once lost, can only be regained at considerable expense of time, money and effort.

Australia can turn the restructuring of the uranium market into a long-term advantage by remaining a flexible, serious and active participant. Opportunities to earn revenues from uranium are still available, although the time horizon for new mines is shifting more than expected into the future. This increase in lead times makes the road from discovery to production more arduous. For developers who can last the distance, the future still looks good.

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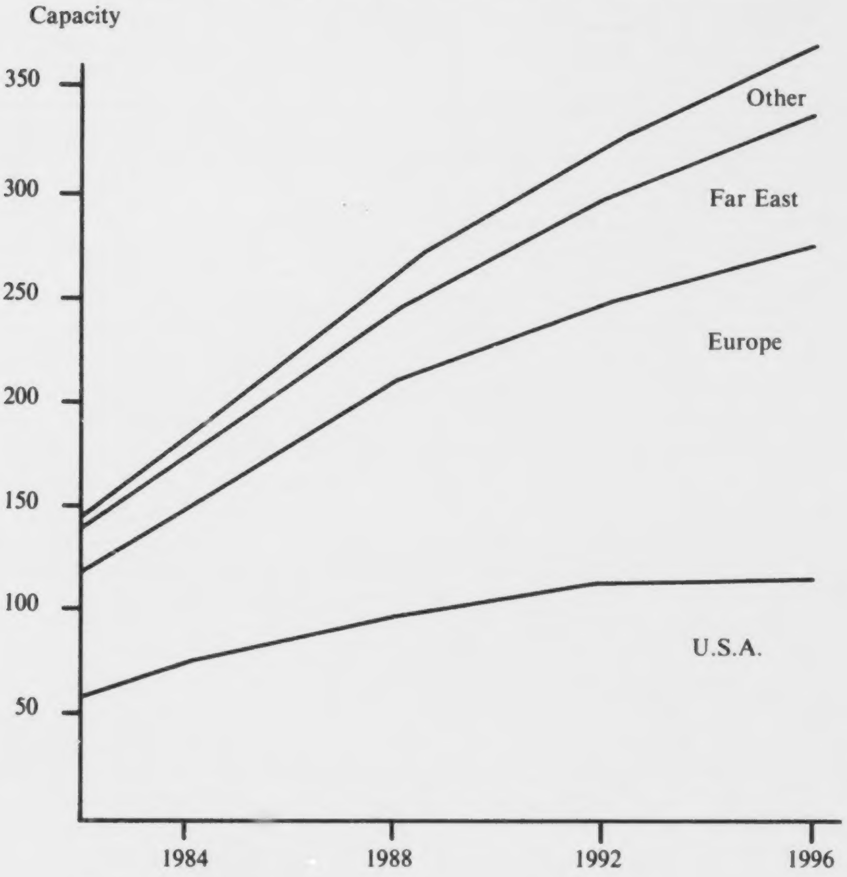
**Figure 1**

**FORECAST OF FREE WORLD NUCLEAR CAPACITY (GWe)**



Source: Nuexco — 12/82

**Figure 2**

**FORECAST OF FREE WORLD NUCLEAR CAPACITY (GWe)**

| | **1982** | **1984** | **1988** | **1992** | **1996** |
|---|---|---|---|---|---|
| U.S.A. | 58.0 | 71.8 | 96.7 | 112.9 | 112.9 |
| Europe | 59.6 | 73.4 | 110.3 | 133.3 | 162.2 |
| Far East | 20.7 | 23.7 | 36.3 | 49.2 | 62.2 |
| Other | 8.0 | 10.3 | 16.7 | 26.0 | 33.2 |
| Total | 146.3 | 179.2 | 260.0 | 321.4 | 370.5 |

Source: Nuexco — 12/82

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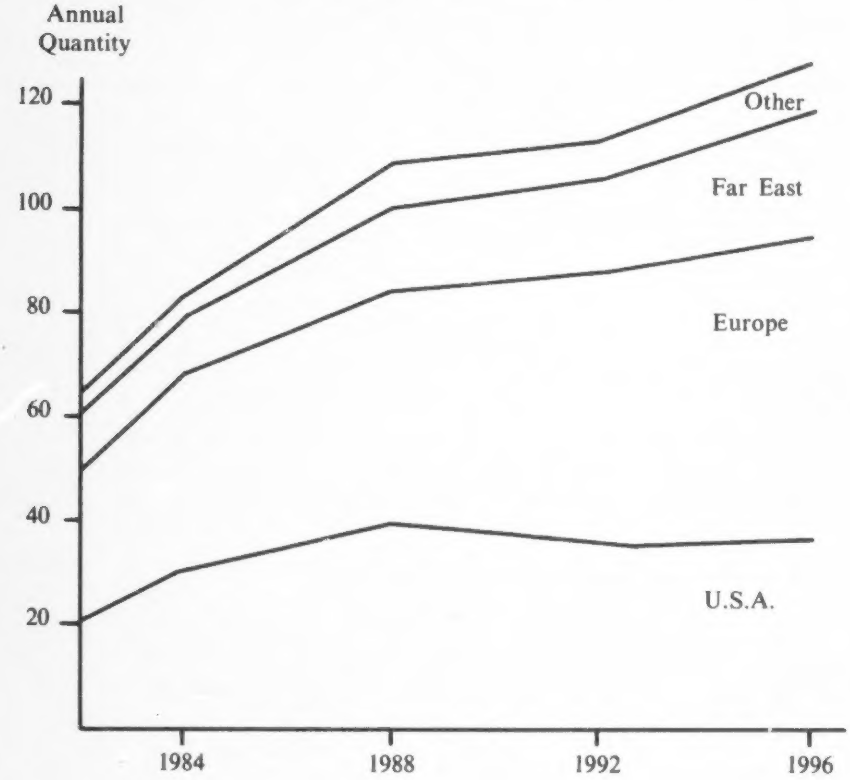
## Figure 3

## FORECAST OF FREE WORLD APPARENT FUTURE CONSUMPTION
(Millions of Pounds $U_3O_8$)



Source: Nuexco — 12/82

## Figure 4

## FORECAST OF FREE WORLD APPARENT FUTURE CONSUMPTION
(Millions of Pounds $U_3O_8$)

| | 1982 | 1984 | 1988 | 1992 | 1996 |
|---|---|---|---|---|---|
| U.S.A. | 20.9 | 30.7 | 39.4 | 35.0 | 35.0 |
| Europe | 27.9 | 36.5 | 44.9 | 51.5 | 59.6 |
| Far East | 10.8 | 11.1 | 15.7 | 16.9 | 22.9 |
| Other | 3.8 | 4.6 | 6.9 | 8.3 | 10.3 |
| Total | 63.4 | 82.9 | 106.9 | 111.7 | 127.8 |

Source: Nuexco — 12/82

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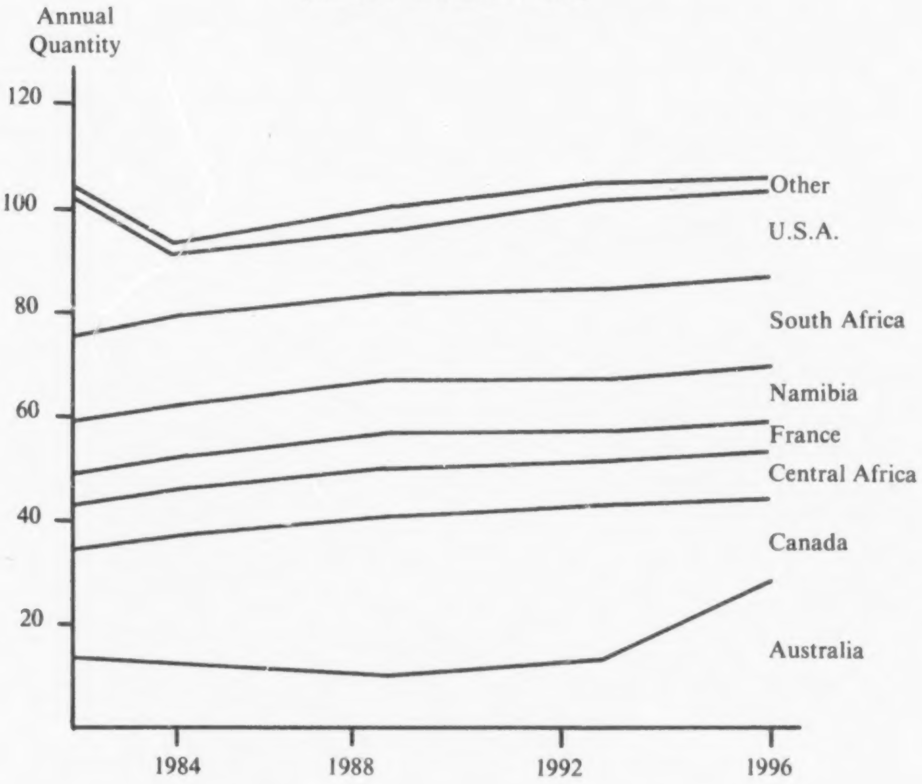
Figure 5

FORECAST OF FREE WORLD URANIUM PRODUCTION
(Millions of Pounds $U_3O_8$)



Source: Nuexco — 12/82

Figure 6

FORECAST OF FREE WORLD URANIUM PRODUCTION
(Millions of Pounds $U_3O_8$)

| | **1982** | **1984** | **1988** | **1992** | **1996** |
|---|---|---|---|---|---|
| Australia | 13.1 | 12.3 | 10.0 | 12.6 | 27.6 |
| Canada | 18.5 | 24.5 | 31.0 | 28.8 | 16.7 |
| Central Africa | 11.7 | 9.0 | 9.0 | 9.0 | 9.0 |
| Namibia | 10.5 | 10.0 | 10.0 | 10.0 | 10.0 |
| South Africa | 15.6 | 17.2 | 17.2 | 17.5 | 17.5 |
| U.S.A. | 25.9 | 12.0 | 12.4 | 16.9 | 15.4 |
| Other Nations | 2.0 | 3.0 | 4.2 | 3.5 | 3.5 |
| Total | 103.2 | 94.0 | 99.8 | 104.3 | 105.6 |

Source: Nuexco — 12/82

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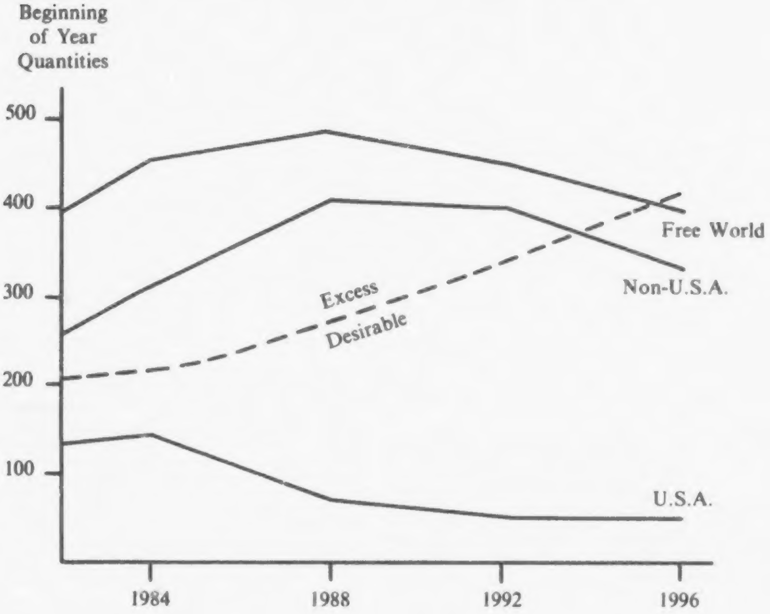
## Figure 7

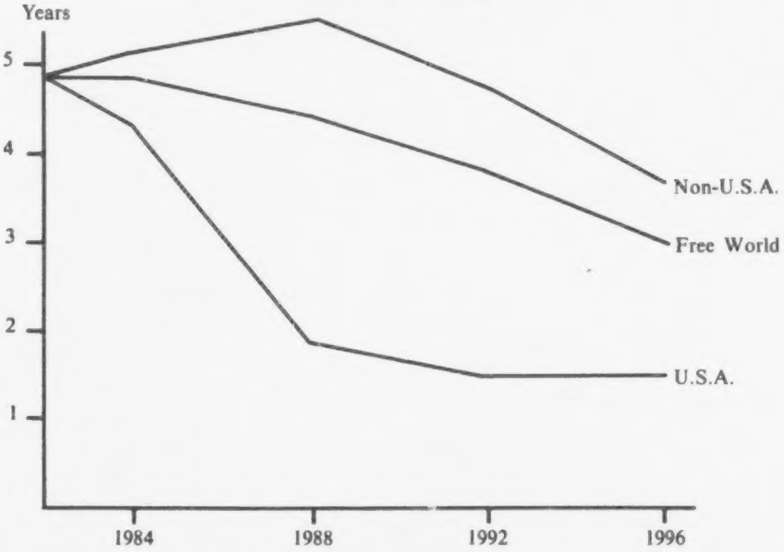
## FORECAST OF FREE WORLD INVENTORIES (Millions of Pounds $U_3O_8$)



Source: Nuexco — 12/82

## Figure 8

## FORECAST OF RELATIVE INVENTORIES (Years of Forward Consumption)



Source: Nuexco — 12/82

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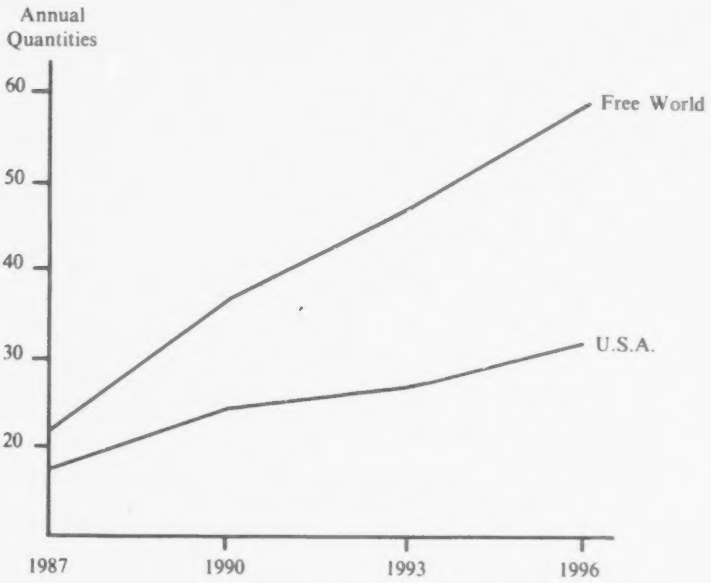
### Figure 9

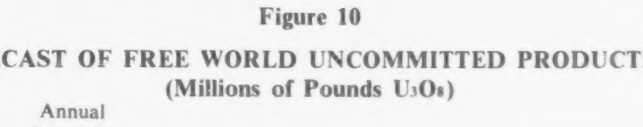
### FORECAST OF FREE WORLD UNFILLED REQUIREMENTS (Millions of Pounds $U_3O_8$)



Source: Nuexco — 12/82

### Figure 10

### FORECAST OF FREE WORLD UNCOMMITTED PRODUCTION (Millions of Pounds $U_3O_8$)



Source: Nuexco — 12/82

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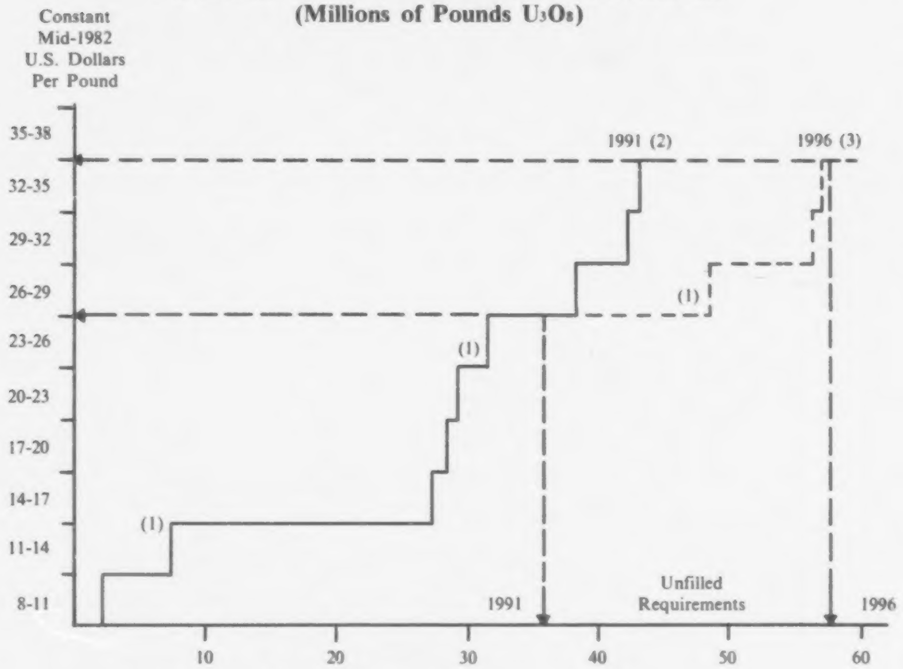
## Figure 11

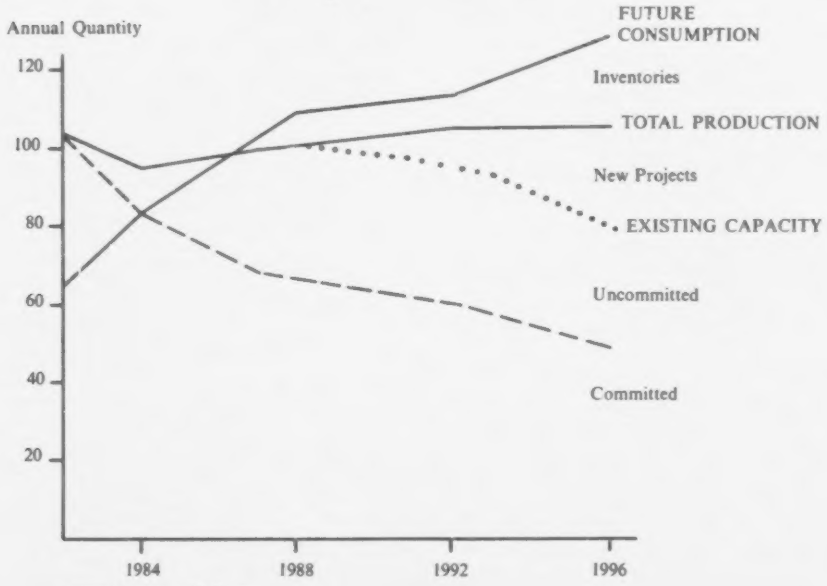
## FORECAST OF UNCOMMITTED PRODUCTION
## (Millions of Pounds $U_3O_8$)



[1]Cost Bands of Australian Production
[2]Does not include New Australian Developments
[3]Includes 15.6 million pounds from New Australian Developments

## Figure 12

## SUPPLY VS. CONSUMPTION
## (Millions of Pounds $U_3O_8$)



Source: Nuexco — 12/82

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# THE URANIUM MARKET: A POSSIBLE TIME OF TRANSITION FOR SOUTHERN AFRICA

By

**James E. Vaughan**
Vice President
Nuexco

Presented To:

**Southern African Metals and Minerals Conference**

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NUEXCO

# THE URANIUM MARKET: A POSSIBLE TIME OF TRANSITION FOR SOUTHERN AFRICA

By: James E. Vaughan
Vice President
Nuexco

## Introduction

Before getting into the subject at hand, let me say a few words about Nuexco, to serve as an introduction and as a basis for the credibility of my remarks.

Nuexco is a privately held US corporation. Our headquarters are in Menlo Park, California. We also have two other offices in the US and one in Europe, near Geneva, where I work. We have representatives in South Africa, Australia, Japan and Taiwan. Altogether, we have 35 full-time employees and representatives whose only task it is to follow the nuclear fuel market. Our principal activities are:

1. Publication of the Monthly Report on the Nuclear Fuel Market.
2. Serving as a broker in nuclear fuel transactions.
3. Providing consulting services on nuclear fuel matters.

Our Monthly Report is received by virtually every participant in the uranium market; users, producers and observers of the market, such as financial institutions. I have often heard it referred to as the "Platt's Oilgram" of uranium. The Monthly Report features supply and demand data for the entire front end of the fuel cycle, and pricing information, including the "Exchange Value," which is a measure of the price of uranium, as of the last day of each month.

## Summary

I will begin by giving you a summary of the brief history of the commercial uranium market. Next, I will discuss our view of the future rate of introduction of nuclear electric generating capacity in the free world (world outside communist areas, or "WOCA"). From this data, a projection of world uranium consumption (i.e., requirements) can be derived. Combining this with Nuexco's data base of the commitments and inventory levels of individual buyers, we can compute unfilled requirements. This approximates the market that South Africa and other uranium producers have available to them.

We can do a similar analysis for the production side. We can estimate world production years into the future, and, combined with Nuexco's data base of producers' commitments to sell, we can derive uncommitted supply for free world producers, including South Africa. This gives us a picture of who will be competing to fill the unfilled requirements, with particular emphasis on the impact on South African producers. Specifically, we see a market for the rest of this decade in which the majority of unfilled requirements are in the United States. American purchasers have become more and more focused on making uranium purchases with prices keyed to spot market, even if associated with long-term contracts. South African producers have relied primarily on long-term contracts with prices not directly related to spot market. Also, there has been almost no direct business done between South African producers and US utilities. In the market which we foresee for the rest of the 1980s, it might be useful for these two divergent groups to find a common ground on which business can be transacted.

We then turn to recent history and examine spot market supply and demand and price. Particular attention is paid to recent inventory sales. The focus is then shifted to the next two years, 1983 and 1984, when inventory sellers are expected to continue to influence the market.

We then look at other matters of importance in the 1980s, including the possibility of significant uranium stockpiling by South African producers and the business environment in which US utilities operate.

## Prices

It should be no secret to anyone at all familiar with the uranium business that spot prices have come down substantially from their lofty heights in the late 1970s. Table I lists Nuexco's Exchange Value from 1968 to the present. Uranium prices were fairly flat since the onset of the commercial uranium business in the late 1960s, at $6 to $7 per pound $U_3O_8$, until early 1974 when they started an exponential rise to more than $40 per pound in early 1976. Prices stayed on a high plateau for about four years, then, at the end of 1979, began to fall rapidly. The Exchange Value went all the way down to $17 in September 1982, before rebounding to the current level of $22.25. A senior official in the South African mining industry stated publicly late last year that the $17 low point marked the lowest real price of uranium in history, when compared to the average cost of producing a pound of uranium by South African Chamber of Mines producers. The data tends to confirm this. The Exchange

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Value averaged about $6 per pound in 1972, and the 1972 average declared working cost by Chamber of Mines producers was 8.79 rand per metric ton of ore milled. The average working cost for 1982 was about 47.2 rand per ton.

Multiplying the Exchange Value ratio (22.25/6) by the working cost ratio (8.79/47.2) and by the change in Exchange rate between the dollar and the rand (1.40) yields a ratio of almost unity. Thus, it is arguable that real spot prices viewed by South African producers are essentially the same now, with the Nuexco Exchange Value at $22.25 per pound, as they were in 1972. Thus, it follows that when the Exchange Value was $17 last September, spot prices were the lowest ever from a South African standpoint. Uranium mining in South Africa has generally been a profitable venture, both in the early 1970s and today; however, it should be noted that most of South Africa's production is now sold under long-term contracts which on the whole are currently bringing above spot market prices.

The illustration in the previous paragraph dramatizes the impact of inflation on the changing fortunes of the uranium producer over the past several years. Putting it another way, the Exchange Value reached $40 per pound in mid-1976. The US Producer Price Index for Industrial Commodities (1967 = 100) has moved from 182.4 in 1976 to about 310 (on a preliminary basis) in 1982. Thus, $40 in 1976 is worth about $68 in current purchasing power, using the US Producer Price Index for Adjustment. Thus, the real price of uranium fell from $68 in mid-1976 to $17 in September 1982, a factor of four! The recent recovery of the Exchange Value to $22.25 has reduced the magnitude of the slide from 1976 to a factor of three.

We see little likelihood of a substantial further recovery of spot prices in the near term. Two basic reasons argue against significantly higher near-term prices. First is the continued existence of a strong secondary market, where holders of inventory are selling material back into the market. Second is a chronic imbalance between consumption and production, which will result in the world's inventory position increasing further over the next few years.

**Uranium Consumption**

Table 2 is Nuexco's forecast of free world (WOCA) installed nuclear electric generating capacity. This is the logical place to start a market analysis since the growth of uranium consumption is primarily dependent upon the growth of nuclear power generation. The growth of nuclear power is analyzed by Nuexco on a country-by-country basis, with attention to probable economics, energy consumption, national energy alternatives, the financial condition of the utilities, licensing considerations, etc. The analysis of generating capacity serves as the basis for calculating future uranium consumption. We expect continued growth of installed nuclear capacity into the 1990s, from 146 gigawatts (GWe) in 1982, to 370 GWe in 1996, a compound increase of about seven percent per year. In a world where 2.8 percent long-term electrical load growth is generally expected, this is quite impressive, albeit not as high as was once anticipated. In the US, we expect to complete most of the plants now under construction or awaiting construction permits, but no new ones. We do expect, however, to see continued growth in Europe and the Far East.

Table 3 represents Nuexco's estimate of "apparent future consumption" of uranium. As used by Nuexco, the term "consumption" refers to a calculation of the uranium which will be, in effect, consumed annually in the operation of nuclear power plants, with time allowed to proceed through the fuel cycle. The methodology of this calculation has been described frequently in the Nuexco Monthly Report, most recently in Report Number 173 dated January 1983. However, it is most important to point out that apparent future consumption is *not* the same as unfilled requirements, since unfilled requirements depend on inventories, existing commitments for future deliveries, and individual utility procurement practices. Consumption on a worldwide basis is forecast by Nuexco to increase from 63 million pounds in 1982 to 128 million pounds in 1996, a compound growth rate of about five percent per year.

Table 4 shows Nuexco's forecast of free world unfilled requirements. This estimate is derived from the apparent future consumption estimate, adjusted by Nuexco's data base of existing inventories and existing commitments for future deliveries on a utility-by-utility basis. The United States tends to dominate the unfilled requirements picture through the end of the decade, with more than two-thirds each year from 1984 through 1990. Unfilled requirements in the Far East are almost negligible through 1990. Unfilled requirements in Europe do not become important until 1988.

The groundrules for which the unfilled requirements calculations were carried out include the assumption that, for the individual utility, material carried in inventory will be used to fill requirements if there are no

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existing commitments to receive uranium from suppliers. In other words, it was assumed that inventories would be drawn down to zero prior to triggering an entry in unfilled requirements. However, we believe that most utilities will elect to carry some inventory to bolster security of supply. Thus, we performed a sensitivity analysis to determine whether the results in Table 4 would change substantially if we imposed minimum forward inventory constraints. This minimum forward inventory would be in addition to the pipeline lead-times already built into the apparent future consumption algorithm (that is, 24 months for first cores and 18 months for reloads). The following minimum inventory levels were assumed: United States, 1.5 years; Europe, 3.0 years; Far East, 5.0 years. The results of this analysis are outlined in Tables 5, 6 and 7 for the US, Europe and the Far East, respectively. It is seen that imposing these additional constraints does not change the result substantially until 1988. Table 5 shows that in 1988, additional unfilled demand is created in the US. Table 6 shows additional demand in Europe at about the same time and in about the same quantities. Table 7 indicates that Far East forward inventories remain above six years during the entire time period of this analysis. A fourth calculation was performed, and the results listed in Table 8, assuming that European utilities will be satisfied with two years forward inventory, in which case no additional demand is created in Europe by these constraints until 1990.

This sensitivity analysis was intended to examine on a macroscopic scale the probable consequences of a wholesale regional desire for a certain inventory level. It does not attempt to look at the behavior of individual utilities, and as such, its usefulness is somewhat limited. Its only real conclusion is that if European utilities, as a whole, will want to keep uranium inventories of two to three years forward consumption and US utilities keep 18 months forward consumption, the conclusions outlined in the remainder of this paper are probably reasonable. That is to say, most unfilled demand will continue to be in the US for the balance of the decade.

**Uranium Production**

We are now ready to take a look at a production forecast. Table 9 contains Nuexco's forecast of WOCA uranium production. WOCA consumption and inventory information is listed on the same Table for reference. It is seen that world production is expected to fall between 1982 and 1983, mainly due to cutbacks in the US. Production then rises slightly until 1986, when it levels off for a few years at about 100 million pounds $U_3O_8$ annually.

This estimate, together with Nuexco's data base of existing delivery commitments, is then used to estimate uncommitted production. Table 10 contains Nuexco's estimate of WOCA uncommitted production, with southern Africa shown separately for comparison.

The production forecast in Table 9 is based on the following general groundrules:

1. African production will generally continue at about its present level for the remainder of the decade.
2. US production will continue to decrease for the next few years.
3. Major new Australian and Canadian projects will suffer continued delays, except Key Lake and Collins Bay in Canada.

**Long-term Market Expectations**

We are now ready to look at the intermediate to long-term outlook for supply and demand. By supply and demand, we are here referring to uncommitted production and unfilled requirements, as we discussed them above. In actuality, however, real demand may be different; for example, real demand may be higher because of greater than anticipated purchasing for inventory. Real supply may also be different. It may be higher, for example, because of higher than anticipated production in the US, or it may be lower because of decisions by South African producers to stockpile rather than sell into the available market. Table 11 compares uncommitted production with unfilled requirements. South African uncommitted production is listed separately. One thing is immediately apparent from Table 11; most of the unfilled requirements in the 1980s are US. If our estimates are reasonably accurate, the South African producer will be looking at a somewhat unfamiliar future, because South African uranium has generally gone to non-US buyers. There have been some exceptions; some uranium from this region has found its way into the US through fuel fabricators, other producers, and trading companies, but little has gone directly to US utilities. There were probably a number of good reasons for this. There has been a great deal of litigation going on in the US over the past several years (some is still going on) that the South African producers were anxious to avoid. On the other hand, from the US utilities' standpoint, they have viewed the US as being self-sufficient in uranium until recently, and if imports were sought at all by US utilities, they were generally

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sought from Canada or, to a lesser extent, Australia. In addition, there was, and unfortunately still is, an institutional bias within most US utilities against contracting for South African supply. I emphasize that the bias is institutional because individual utility fuel managers generally recognize South Africa's exemplary delivery record and high quality product. To understand the reasons for this problem, one has to examine the open environment in which the US utility generally operates. It has been described as a "goldfish bowl." As a result, US utility executives are constantly exposed to second-guessing, especially by regulatory agencies and the news media. Partially as a result of this situation, and as a consequence of their basic charter which is to supply reliable electric service, their business philosophy is usually one of risk avoidance.

Among the risks utilities, as institutions, tend to avoid is political controversy. Contracting directly with a South African company might be viewed by US utility executives as setting themselves up for criticism by regulators, shareholders and the media, not because of any questions of reliability, but simply for political reasons revolving around South Africa's racial policies as viewed by the US observer (albeit, admittedly, often through the polarized eyes of the US news media).

The data in Table 11 indicates it is quite possible that US users and South African producers will somehow be drawn together during this decade, either directly or, as before, indirectly because of the dominance of US unfilled requirements through 1990. It has been suggested that an alternative for the South African producers would be massive stockpiling of uranium, either in the form of concentrates, or in the form of slimes, to be recovered later (probably near the end of mine life). It has, at the same time, been suggested that the South African government would, in effect, pick up a large percentage of the cost of stockpiling, since annual operating losses from uranium production would be deductible from profits on gold sales. Thus, if uranium were not sold, its cost of production would have no associated revenue, and would thus offset gold revenues, since the two accounts are considered together for government tax and royalty purposes. The current S.A. government combined tax and royalty rate is about 65 percent of profits, so as long as gold production is reasonably profitable, the government would finance two-thirds of stockpiling costs. This reasoning would be fine if the government would go along with the idea; however, it has apparently been agreed that, for purposes of tax and royalty calculations, stockpiled uranium is to be valued at its cost of production. Thus, the government's subsidy would drop from two-thirds to near zero, so there appears to be no real tax advantage to stockpiling under those conditions.

There may be another advantage of stockpiling, at least for the near term. Most South African uranium is sold under long-term contracts with prices subject to annual negotiation. It is generally believed that these annual negotiations have in recent years yielded prices higher than the spot market. Selling new material at or near current spot market prices may be viewed by South African producers as inimical to their annual negotiations with their existing long-term buyers. Thus, we may expect some stockpiling of unsold production, at least until spot prices are more in line with the annually negotiated prices under long-term contracts, or until the size of the stockpile becomes burdensome. The extent to which the stockpile does become burdensome would, of course, depend rather importantly on the price of gold.

**Near-term Market Expectations**

Before we take a look at the next two years or so, it may be instructive to look at the last few years. We have already discussed the price slide which began in late 1979. Why did this happen? Part of the answer can be seen by comparing the size of the WOCA 1983 beginning-of-the-year commercial inventory, 438 million pounds $U_3O_8$, with the 1983 anticipated production, 90 million pounds. Uranium production has exceeded consumption every year since the inception of the commercial uranium market. Due to extensive delays and cancellations of nuclear power capacity, some of this inventory has found its way back into the market to compete with primary production in an already crowded market. The result was downward pressure on prices. This phenomenon reached something of a crisis in 1982 as shown in Table 12. The year 1981 ended with a near-term supply-demand ratio of about two. The terms supply and demand are somewhat more rigorous terms when used in a near-term sense, as compared to the longer-term discussion above. Near-term supply means the total of material actively being offered for sale and delivery within one year of the date in question. Near-term demand is material actively being sought for near-term delivery. During 1982, the supply-demand ratio gradually rose from 3.5 in January to 16 in June. There was a great deal of competition among inventory holders to make sales during 1982. At least nine separate entities

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sold quantities in excess of one million pounds $U_3O_8$ on the near-term market. On the demand side, there were a number of bargain hunters in the market from all over the world, utility and producer alike. Toward the end of 1982, many of the sellers in the market had accomplished their purposes and, having done so, withdrew from the market. Thus, the market began firming a bit. The supply-demand ratio went back down to more resonable levels.

Looking a year or two into the future, we see continued importance of inventory sellers. Some are still active in the market. Others are on the sidelines, either preparing to sell, or waiting to see if prices come up somewhat. There is also uncommitted production from producers which may find its way into the near-term market. With inventory redistribution likely to continue, it is difficult to see a mechanism for substantial price strengthening in the near term. We believe it will take at least a year or two for the inventory redistribution problem to be solved; that is, for inventory to pass from weak hands to strong. A great deal of this inventory has found its way into the hands of some US producers which have trimmed production and are instead buying on the spot market to deliver under existing contracts.

### The Spot Market

We can now turn to a brief discussion of the spot market, and one of its barometers, the Nuexco Exchange Value. The spot market in the last 12 to 18 months has been relatively hectic. I say relatively, because the uranium market, as commodity markets go, has a fairly high time constant; it moves rather slowly. Referring back to Table 1, the market arguably began a business cycle back in the early 1970s and appears to be completing it about now. Given the long lead times in nuclear power, and the fact that uranium is a commodity with only that one use, this long business cycle should not be surprising. The spot market for uranium has traditionally been rather thin, with about 85 to 90 percent of annual production sold on a long-term basis.

Lately, however, the spot market volume has been picking up, especially with the rise of the secondary market for uranium (i.e., resale by inventory holders). Commodity market observers hasten to point out that this is quite normal as a market moves towards maturity. Spot market activity not only becomes important in and of itself, but it also tends to influence longer-term relationships by providing a reference price level, or perhaps the actual price for deliveries under long-term contracts. Things appear to be headed in this general direction in uranium. Not only are unusually large (by past standards) quantities of uranium trading on the spot market, but many new long-term contracts contain pricing formulas in some way related to the spot price, often specifically to the Exchange Value.

One factor pushing in the direction of increased importance of the spot market price is the business philosophy of the US utility, and the existence in the US of the so-called fuel adjustment clause. As we have discussed, the charter of the electric utility, namely reliable service, dictates a strategy of risk avoidance. This philosophy, in combination with the near-universality in the US of the fuel adjustment clause, results in an emphasis in the US on buying at spot market prices. If the utility buys uranium "below the market price," the benefits flow not to the company, but to the ratepayer, since fuel costs are generally passed through to customers under the fuel adjustment clause. This ratemaking clause was adopted almost everywhere in the US during the 1970s when the cost of all fuel was rapidly rising. However, an apparent corollary of this type of rate relief is the necessity to demonstrate that the utility is still being prudent and not paying above market price. If the utility fuel buyer pays "more than market price," he is at best embarrassed in front of his management. Even worse, the company may be called to task by the usually politically motivated regulatory authorities. Worst of all, we have seen cases where the utility shareholders have had to absorb any price differential above market. Thus, the utility policy of risk avoidance translates into a desire to buy fuel at market price. Who can criticize you for paying the going rate, whatever it is? As a result, US utilities now generally refuse to enter into contracts which might require them to pay more than market price. Thus, we now see many long-term uranium contracts under which all deliveries actually made are priced on the basis of some spot market indicator. Again, this has ample precedent in other commodity markets.

Security of supply has dropped to a lower level of importance in the US utility, the theory apparently being that, at some price, uranium can always be obtained, and under presently existing conditions, that cost can always be passed on to electricity users as long as it is "at market" or below. That phenomenon, together with the large existing US commercial inventories (to say nothing of the equally large US DOE strategic inventory) has at this time put security of supply concerns at a somewhat lower level of priority than price in the US.

This concludes my prepared remarks, except for a somewhat philosophical concluding statement. Market participants would do well to carefully study what observers like Nuexco say about the market, and carefully compare our views with other observers. At such time as we all appear to be saying the same thing, that is the time to engage the "theory of contrary opinion," and begin looking for reasons for why the crowd may be wrong. When all the experts are saying the same thing, all the people who listen to the experts are probably doing the same thing, and that is the time when interesting opportunities tend to develop for those who are alert enough to recognize them. This kind of philosophy usually works best near the bottom and near the top of business cycles.

**Table 1**

**HISTORICAL NUEXCO EXCHANGE VALUES**

Determined as of the last day of the month indicated (US Dollars/lb. $U_3O_8$)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1968 | — | — | — | — | — | — | — | 6.35 | 6.35 | 6.40 | 6.45 | 6.50 |
| 1969 | — | 6.35 | 6.10 | 6.10 | 6.25 | 6.25 | 6.20 | 6.20 | 6.15 | 6.15 | 6.15 | 6.20 |
| 1970 | 6.30 | 6.30 | 6.30 | 6.30 | 6.30 | 6.30 | 6.30 | 6.20 | 6.15 | 6.15 | 6.15 | 6.15 |
| 1971 | 6.20 | 6.20 | 6.20 | 6.20 | 6.15 | 6.05 | 6.00 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 |
| 1972 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 |
| 1973 | 5.95 | 6.00 | 6.10 | 6.20 | 6.45 | 6.50 | 6.50 | 6.50 | 6.50 | 6.50 | 6.75 | 7.00 |
| 1974 | 7.70 | 7.90 | 8.00 | 9.00 | 9.50 | 10.50 | 11.50 | 12.00 | 12.50 | 14.00 | 14.75 | 15.00 |
| 1975 | 16.00 | 16.00 | 18.00 | 20.00 | 21.00 | 23.00 | 24.70 | 26.00 | 26.00 | 28.50 | 30.00 | 35.00 |
| 1976 | 35.20 | 37.00 | 39.25 | 40.00 | 40.00 | 40.00 | 40.00 | 40.40 | 41.00 | 41.00 | 41.50 | 41.00 |
| 1977 | 41.35 | 41.50 | 41.60 | 41.60 | 42.00 | 42.25 | 42.25 | 42.25 | 42.40 | 42.75 | 43.20 | 43.20 |
| 1978 | 42.90 | 43.25 | 43.25 | 43.25 | 43.40 | 43.40 | 43.40 | 43.10 | 43.25 | 43.00 | 43.25 | 43.25 |
| 1979 | 43.25 | 43.25 | 43.25 | 43.25 | 43.25 | 43.00 | 42.70 | 42.70 | 42.20 | 42.20 | 41.00 | 40.75 |
| 1980 | 40.00 | 38.00 | 35.00 | 32.00 | 32.00 | 31.50 | 31.50 | 30.00 | 28.50 | 28.00 | 28.00 | 27.00 |
| 1981 | 25.00 | 25.00 | 25.00 | 25.00 | 25.00 | 24.25 | 23.50 | 23.50 | 23.50 | 23.50 | 23.50 | 23.50 |
| 1982 | 23.00 | 23.00 | 22.50 | 20.75 | 20.50 | 19.25 | 18.25 | 17.00 | 17.00 | 17.50 | 19.75 | 20.25 |
| 1983 | 21.50 | 21.75 | **22.25** | | | | | | | | | |

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## Table 2

### NUCLEAR ELECTRIC GENERATING CAPACITY[1] [2]
(Thousands of MWe — Net)

| **BUYER GROUP** | **1982** | **1983** | **1984** | **1985** | **1986** | **1987** | **1988** | **1989** | **1990** | **1991** |
|---|---|---|---|---|---|---|---|---|---|---|
| United States | | | | | | | | | | |
| Reactors now operational | 58.0 | 58.0 | 58.0 | 58.0 | 58.0 | 58.0 | 58.0 | 58.0 | 58.0 | 58.0 |
| Now under construction | 0 | 6.4 | 13.8 | 20.4 | 29.1 | 34.4 | 38.7 | 44.0 | 51.7 | 53.8 |
| Now on order/planned/future | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| US Subtotal | 58.0 | 64.4 | 71.8 | 78.4 | 87.1 | 92.4 | 96.7 | 102.0 | 109.7 | 111.8 |
| Europe | | | | | | | | | | |
| Reactors now operational | 54.5 | 54.5 | 54.5 | 54.5 | 54.5 | 54.5 | 54.5 | 54.5 | 54.5 | 54.4 |
| Now under construction | 5.1 | 13.7 | 18.9 | 27.9 | 37.5 | 48.3 | 55.8 | 59.6 | 63.5 | 63.5 |
| Now on order/planned/future | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.3 | 2.5 | 9.4 |
| Europe Subtotal | 59.6 | 68.2 | 73.4 | 82.4 | 92.0 | 102.8 | 110.3 | 115.4 | 120.5 | 127.3 |
| Far East[3] | | | | | | | | | | |
| Reactors now operational | 20.7 | 20.7 | 20.7 | 20.7 | 20.7 | 20.7 | 20.7 | 20.7 | 20.7 | 20.7 |
| Now under construction | 0 | 0 | 3.0 | 5.8 | 9.6 | 11.8 | 14.5 | 16.3 | 16.3 | 17.2 |
| Now on order/planned/future | 0 | 0 | 0 | 0 | 0 | 0 | 1.1 | 2.7 | 5.7 | 8.7 |
| Far East Subtotal | 20.7 | 20.7 | 23.7 | 26.5 | 30.3 | 32.5 | 36.3 | 39.7 | 42.7 | 46.6 |
| Other Free World[4] | | | | | | | | | | |
| Reactors now operational | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 |
| Now under construction | 0 | 0.9 | 2.3 | 4.3 | 6.4 | 7.7 | 8.7 | 10.7 | 12.5 | 13.4 |
| Now on order/planned/future | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.2 | 1.8 | 2.7 |
| Other Subtotal | 8.0 | 8.9 | 10.3 | 12.3 | 14.4 | 15.7 | 16.7 | 19.9 | 22.3 | 24.1 |
| FREE WORLD[4] TOTAL | 146.3 | 162.2 | 179.2 | 199.6 | 223.8 | 243.4 | 260.0 | 277.0 | 295.2 | 309.8 |
| Worldwide Breakdown by Status | | | | | | | | | | |
| Reactors now operational | 141.2 | 141.2 | 141.2 | 141.2 | 141.2 | 141.2 | 141.2 | 141.2 | 141.2 | 141.1 |
| Now under construction | 5.1 | 21.0 | 38.0 | 58.4 | 82.6 | 102.2 | 117.7 | 130.6 | 144.0 | 147.9 |
| Now on order/planned/future | 0 | 0 | 0 | 0 | 0 | 0 | 1.1 | 5.2 | 10.0 | 20.8 |

---

[1] Installed as of year end

[2] Uses Nuexco's estimates of commercial operating dates

[3] Japan, Korea, Taiwan, Philippines

[4] Excludes Bulgaria, Czechoslovakia, German Democratic Republic, Finland (two Russian reactors), Hungary, People's Republic of China, Poland, Romania, USSR

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## Table 3

## APPARENT FUTURE CONSUMPTION[1]

(Millions of Pounds $U_3O_8$)

| BUYER GROUP | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 |
|---|---|---|---|---|---|---|---|---|---|---|
| United States | | | | | | | | | | |
| Reactors now operational | 19.1 | 19.1 | 19.1 | 19.1 | 18.8 | 18.5 | 18.2 | 17.9 | 17.7 | 17.4 |
| Now under construction | 1.8 | 5.5 | 11.6 | 12.5 | 14.7 | 16.8 | 21.2 | 16.8 | 18.0 | 17.3 |
| Now on order/planned/future | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| US Subtotal | 20.9 | 24.6 | 30.7 | 31.6 | 33.5 | 35.3 | 39.4 | 34.7 | 35.7 | 34.7 |
| Europe | | | | | | | | | | |
| Reactors now operational | 21.0 | 21.3 | 21.3 | 21.0 | 21.0 | 20.8 | 20.4 | 20.2 | 20.0 | 19.3 |
| Now under construction | 6.9 | 13.0 | 15.2 | 22.0 | 20.9 | 20.6 | 21.9 | 22.0 | 21.0 | 21.3 |
| Now on order/planned/future | 0 | 0 | 0 | 0 | 0 | 1.3 | 2.6 | 4.2 | 5.9 | 7.5 |
| Europe Subtotal | 27.9 | 34.3 | 36.5 | 43.0 | 41.9 | 42.7 | 44.9 | 46.4 | 46.9 | 48.1 |
| Far East[2] | | | | | | | | | | |
| Reactors now operational | 7.6 | 7.6 | 7.6 | 7.4 | 7.2 | 7.0 | 6.9 | 6.8 | 6.6 | 6.4 |
| Now under construction | 3.2 | 3.2 | 3.5 | 4.7 | 6.0 | 5.2 | 4.9 | 6.1 | 6.0 | 5.2 |
| Now on order/planned/future | 0 | 0 | 0 | 0 | 1.2 | 2.8 | 3.9 | 4.6 | 4.0 | 8.0 |
| Far East Subtotal | 10.8 | 10.8 | 11.1 | 12.1 | 14.4 | 15.0 | 15.7 | 17.5 | 16.6 | 19.6 |
| Other Free World[3] | | | | | | | | | | |
| Reactors now operational | 2.8 | 2.8 | 2.8 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 1.9 | 1.9 |
| Now under construction | 1.0 | 1.4 | 1.8 | 1.6 | 2.2 | 3.8 | 3.6 | 3.1 | 3.2 | 3.2 |
| Now on order/planned/future | 0 | 0 | 0 | 0 | 0 | 1.2 | 0.9 | 1.0 | 2.0 | 2.4 |
| Other Subtotal | 3.8 | 4.2 | 4.6 | 4.0 | 4.6 | 7.4 | 6.9 | 6.5 | 7.1 | 7.5 |
| FREE WORLD[3] TOTAL | 63.4 | 73.9 | 82.9 | 90.7 | 94.4 | 100.4 | 106.9 | 105.1 | 106.3 | 109.9 |
| Worldwide Breakdown by Status | | | | | | | | | | |
| Reactors now operational | 50.5 | 50.8 | 50.8 | 49.9 | 49.4 | 48.7 | 47.9 | 47.3 | 46.2 | 45.0 |
| Now under construction | 12.9 | 23.1 | 32.1 | 40.8 | 43.8 | 46.4 | 51.6 | 48.0 | 48.2 | 47.0 |
| Now on order/planned/future | 0 | 0 | 0 | 0 | 1.2 | 5.3 | 7.4 | 9.8 | 11.9 | 17.9 |

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[1] Computed quantities of $U_3O_8$ which would be used under the given conditions to fabricate fuel for loading and reloading reactors operational, under construction, on order, or forecasted as of September 30, 1982. Compiled and computed on a reactor by reactor basis, quantities for each reactor are based on specific core characteristics, 0.25% tails assay, no recycling, 24-month lead time for procuring first cores and 18-month lead time for procuring each reload. Estimates reflect annual consumption displaced in time to the start of the conversion-enrichment-fabrication cycle for timely loading into the reactor; they do not reflect refueling cycles.

[2] Japan, Korea, Taiwan, Philippines

[3] Excludes Bulgaria, Czechoslovakia, German Democratic Republic, Finland (two Russian reactors), Hungary, People's Republic of China, Poland, Romania, USSR

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## Table 4

## UNFILLED REQUIREMENTS
(Millions of Pounds $U_3O_8$, Equivalent)

| | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 |
|---|---|---|---|---|---|---|---|---|---|
| Europe | 0.8 | 1.0 | 1.0 | 2.0 | 3.2 | 5.5 | 5.3 | 9.3 | 10.1 |
| Far East | 0 | 0 | 0 | 0.1 | 0 | 1.0 | 3.0 | 1.8 | 3.2 |
| Other Nations (ex-US) | 1.7 | 1.7 | 2.6 | 1.2 | 1.0 | 1.9 | 0.9 | 1.2 | 1.2 |
| SUBTOTAL Non-US | 2.5 | 2.7 | 3.6 | 3.3 | 4.2 | 8.4 | 9.2 | 12.3 | 14.5 |
| United States | 3.2 | 9.0 | 9.3 | 19.7 | 17.7 | 20.5 | 23.1 | 24.4 | 22.8 |
| TOTAL Free World | 5.7 | 11.7 | 12.9 | 23.0 | 21.9 | 28.9 | 32.3 | 36.7 | 37.3 |

## Table 5

## SUPPLY-DEMAND BALANCE: US
## [ONE AND ONE-HALF YEARS' DESIRED RELATIVE INVENTORY]
(Millions of Pounds $U_3O_8$ Equivalent)

| | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 |
|---|---|---|---|---|---|---|---|---|---|---|
| Production[1] | 25.9 | 14.7 | 12.0 | 12.4 | 12.3 | 12.0 | 12.4 | 12.6 | 13.4 | 16.9 |
| less | | | | | | | | | | |
| Consumption[2] | 20.9 | 24.6 | 30.7 | 31.6 | 33.5 | 35.3 | 39.4 | 34.7 | 35.7 | 34.7 |
| plus | | | | | | | | | | |
| Net Imports/(Exports)[3] | 3.5 | 6.0 | 3.0 | 1.7 | 1.9 | 1.9 | 2.3 | 2.4 | 2.4 | 2.4 |
| equals | | | | | | | | | | |
| Supply Surplus/(Deficit) | 8.5 | (3.9) | (15.7) | (17.5) | (19.3) | (21.4) | (24.7) | (19.7) | (19.9) | (15.4) |
| plus | | | | | | | | | | |
| Beginning Inventory | 138.8[4] | 147.3 | 143.4 | 127.7 | 110.2 | 90.9 | 69.5 | 56.8 | 52.6 | 53.1 |
| equals | | | | | | | | | | |
| Nominal Inventory | 147.3 | 143.4 | 127.7 | 110.2 | 90.9 | 69.5 | 44.8 | 37.1 | 32.7 | 37.7 |
| less | | | | | | | | | | |
| Minimum Inventory | 33.2 | 40.0 | 46.5 | 48.4 | 51.2 | 55.0 | 56.8 | 52.6 | 53.1 | 52.2 |
| equals | | | | | | | | | | |
| Excess Inventory/(Unfilled Demand) | 114.1 | 103.4 | 81.2 | 61.8 | 39.7 | 14.5 | (12.0) | (15.5) | (20.4) | (14.5) |
| Adjusted Ending Inventory | 147.3 | 143.4 | 127.7 | 110.2 | 90.9 | 69.5 | 56.8 | 52.6 | 53.1 | 52.2 |
| Relative Inventory (years)[5] | 4.9 | 4.8 | 4.3 | 3.7 | 3.1 | 2.5 | 1.9 | 1.5 | 1.5 | 1.5 |

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[1] Report 172, Table 3

[2] Report 173, Table 9

[3] Report 173, Table 16

[4] Commercial inventory only. Nuexco Report 170, page 19, Table 3

[5] For each year, Relative Inventory equals the number of years of forward consumption which could be supplied by that year's Beginning Inventory.

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### Table 6

## SUPPLY-DEMAND BALANCE: EUROPE
## [THREE YEARS' DESIRED RELATIVE INVENTORY]
### (Millions of Pounds $U_3O_8$ Equivalent)

| | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 |
|---|---|---|---|---|---|---|---|---|---|---|
| Production | 6.6 | 6.7 | 6.7 | 7.4 | 8.1 | 8.1 | 8.1 | 8.1 | 8.1 | 7.7 |
| less | | | | | | | | | | |
| Consumption | 27.9 | 34.3 | 36.5 | 43.0 | 41.9 | 42.7 | 44.9 | 46.4 | 46.9 | 48.1 |
| plus | | | | | | | | | | |
| Net Imports | 34.2 | 34.8 | 34.3 | 34.1 | 34.9 | 28.8 | 28.9 | 23.1 | 23.0 | 22.1 |
| equals | | | | | | | | | | |
| Supply Surplus/(Deficit) | 12.9 | 7.2 | 4.5 | (1.5) | 1.1 | (5.8) | (7.9) | (15.2) | (15.8) | (18.3) |
| plus | | | | | | | | | | |
| Beginning Inventory | 108.7[1] | 121.6 | 128.8 | 133.3 | 131.8 | 132.9 | 134.0 | 138.2 | 141.4 | 146.5 |
| equals | | | | | | | | | | |
| Nominal Inventory | 121.6 | 128.8 | 133.3 | 131.8 | 132.9 | 127.1 | 126.1 | 123.0 | 125.6 | 128.2 |
| less | | | | | | | | | | |
| Minimum Inventory | 98.7 | 113.8 | 121.4 | 127.6 | 129.5 | 134.0 | 138.2 | 141.4 | 146.5 | 154.6 |
| equals | | | | | | | | | | |
| Excess Inventory/ (Unfilled Demand) | 22.9 | 15.0 | 11.9 | 4.2 | 3.4 | (6.9) | (12.1) | (18.4) | (20.9) | (26.4) |
| Adjusted Ending Inventory | 121.6 | 128.8 | 133.3 | 131.8 | 132.9 | 134.0 | 138.2 | 141.4 | 146.5 | 154.6 |
| Relative Inventory (years)[5] | 3.5 | 3.4 | 3.3 | 3.1 | 3.1 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |

[1] Nuexco estimate — commercial inventory only

### Table 7

## SUPPLY-DEMAND BALANCE: FAR EAST
## [FIVE YEARS' DESIRED RELATIVE INVENTORY]
### (Millions of Pounds $U_3O_8$ Equivalent)

| | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 |
|---|---|---|---|---|---|---|---|---|---|---|
| Imports | 22.4 | 24.9 | 21.6 | 26.0 | 22.7 | 20.3 | 19.9 | 18.7 | 18.5 | 18.5 |
| less | | | | | | | | | | |
| Consumption | 10.8 | 10.8 | 11.1 | 12.1 | 14.5 | 15.0 | 15.7 | 17.5 | 16.6 | 19.7 |
| equals | | | | | | | | | | |
| Supply Surplus/(Deficit) | 11.6 | 14.1 | 10.5 | 13.9 | 8.2 | 5.3 | 4.2 | 1.2 | 1.9 | (1.2) |
| plus | | | | | | | | | | |
| Beginning Inventory | 77.6[1] | 89.2 | 103.3 | 113.8 | 127.7 | 135.9 | 141.2 | 145.4 | 146.6 | 148.5 |
| equals | | | | | | | | | | |
| Nominal Inventory | 89.2 | 103.3 | 113.8 | 127.7 | 135.9 | 141.2 | 145.4 | 146.6 | 148.5 | 147.3 |
| less | | | | | | | | | | |
| Minimum Inventory | 59.3 | 63.5 | 68.4 | 74.8 | 79.3 | 84.5 | 86.5 | 90.5 | 94.7 | 98.2 |
| equals | | | | | | | | | | |
| Excess Inventory | 29.9 | 39.8 | 45.4 | 52.9 | 56.6 | 56.7 | 58.9 | 56.1 | 53.8 | 49.1 |
| Adjusted Ending Inventory | 89.2 | 103.3 | 113.8 | 127.7 | 135.9 | 141.2 | 145.4 | 146.6 | 148.5 | 147.3 |
| Relative Inventory (years) | 6.2 | 6.6 | 7.0 | 7.2 | 7.6 | 7.7 | 7.7 | 7.6 | 7.4 | 7.2 |

[1] Nuexco estimate

## Table 8
## SUPPLY-DEMAND BALANCE: EUROPE
## [TWO YEARS' DESIRED RELATIVE INVENTORY]
### (Millions of Pounds $U_3O_8$ Equivalent)

| | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 |
|---|---|---|---|---|---|---|---|---|---|---|
| Production | 6.6 | 6.7 | 6.7 | 7.4 | 8.1 | 8.1 | 8.1 | 8.1 | 8.1 | 7.7 |
| less | | | | | | | | | | |
| Consumption | 27.9 | 34.3 | 36.5 | 43.0 | 41.9 | 42.7 | 44.9 | 46.4 | 46.9 | 48.1 |
| plus | | | | | | | | | | |
| Net Imports | 34.2 | 34.8 | 34.3 | 34.1 | 34.9 | 28.8 | 28.9 | 23.1 | 23.0 | 22.1 |
| equals | | | | | | | | | | |
| Supply Surplus/(Deficit) | 12.9 | 7.2 | 4.5 | (1.5) | 1.1 | (5.8) | (7.9) | (15.2) | (15.8) | (18.3) |
| plus | | | | | | | | | | |
| Beginning Inventory | 108.7[1] | 121.6 | 128.8 | 133.3 | 131.8 | 132.9 | 127.1 | 119.2 | 104.0 | 95.0 |
| equals | | | | | | | | | | |
| Nominal Inventory | 121.6 | 128.8 | 133.3 | 131.8 | 132.9 | 127.1 | 119.2 | 104.0 | 88.2 | 76.7 |
| less | | | | | | | | | | |
| Minimum Inventory | 62.2 | 70.8 | 79.5 | 84.9 | 84.6 | 87.6 | 91.3 | 93.3 | 95.0 | 99.6 |
| equals | | | | | | | | | | |
| Excess Inventory/ (Unfilled Demand) | 59.4 | 58.0 | 53.8 | 46.9 | 48.3 | 39.5 | 27.9 | 10.7 | (6.8) | (22.9) |
| Adjusted Ending Inventory | 121.6 | 128.8 | 133.3 | 131.8 | 132.9 | 127.1 | 119.2 | 104.0 | 95.0 | 99.6 |
| Relative Inventory (years) | 3.5 | 3.4 | 3.3 | 3.1 | 3.1 | 2.9 | 2.6 | 2.2 | 2.0 | 2.0 |

[1] Nuexco estimate — commercial inventory only

## Table 9
## URANIUM SUPPLY-DEMAND BALANCE: WOCA[1]
### (Millions of Pounds $U_3O_8$ Equivalent)

| | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 |
|---|---|---|---|---|---|---|---|---|---|---|
| PRODUCTION[2] | | | | | | | | | | |
| Operating production centers | 102.5 | 87.2 | 85.1 | 85.8 | 86.6 | 85.5 | 84.6 | 84.8 | 84.4 | 88.6 |
| Facilities under construction | 0.7 | 3.2 | 8.9 | 9.6 | 13.3 | 13.3 | 14.2 | 13.8 | 13.8 | 13.1 |
| Planned facilities | 0 | 0 | 0 | 0 | 0.5 | 1.0 | 1.0 | 1.0 | 2.0 | 4.0 |
| Total | 103.2 | 90.4 | 94.0 | 95.4 | 100.4 | 99.8 | 99.8 | 99.6 | 100.2 | 105.7 |
| less | | | | | | | | | | |
| CONSUMPTION[3] | 63.4 | 73.9 | 82.9 | 90.7 | 94.4 | 100.4 | 106.9 | 105.1 | 106.3 | 109.9 |
| equals | | | | | | | | | | |
| NET INVENTORY INCREASE/(DECREASE) | 39.8 | 16.5 | 11.1 | 4.7 | 6.0 | (0.6) | (7.1) | (5.5) | (6.1) | (4.2) |
| plus | | | | | | | | | | |
| BEGINNING INVENTORY | 397.9[4] | 437.7 | 454.2 | 465.3 | 470.0 | 476.0 | 475.4 | 468.3 | 462.8 | 456.7 |
| equals | | | | | | | | | | |
| ENDING INVENTORY | 437.7 | 454.2 | 465.3 | 470.0 | 476.0 | 475.4 | 468.3 | 462.8 | 456.7 | 452.5 |
| RELATIVE INVENTORY (years)[5] | 4.9 | 5.0 | 4.8 | 4.7 | 4.6 | 4.5 | 4.4 | 4.3 | 4.1 | 4.0 |

[1] Excludes Communist areas

[2] Nuexco Report 172, Table 5

[3] Report 173, Table 9

[4] Nuexco estimate — commercial inventory only

[5] For each year, Relative Inventory equals the number of years of forward consumption which could be supplied by that year's Beginning Inventory.

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### Table 10

### NUEXCO ESTIMATE OF UNCOMMITTED PRODUCTION

(Millions of Pounds $U_3O_8$)

| Year | Southern Africa | Other WOCA | Total |
|---|---|---|---|
| 1984 | 2 | 8 | 10 |
| 1985 | 5 | 11 | 16 |
| 1986 | 8 | 18 | 26 |
| 1987 | 9 | 21 | 30 |
| 1988 | 10 | 22 | 32 |
| 1989 | 11 | 25 | 36 |
| 1990 | 11 | 26 | 37 |
| 1991 | 12 | 31 | 43 |

### Table 11

### NUEXCO ESTIMATE OF UNCOMMITTED PRODUCTION AND UNFILLED REQUIREMENTS

(Millions of Pounds $U_3O_8$)

| | Uncommitted Production | | Unfilled Requirements | |
|---|---|---|---|---|
| | WOCA | Southern Africa | WOCA | Non-US |
| 1984 | 10 | 2 | 12 | 3 |
| 1985 | 16 | 5 | 13 | 4 |
| 1986 | 26 | 8 | 23 | 3 |
| 1987 | 30 | 9 | 22 | 4 |
| 1988 | 32 | 10 | 29 | 8 |
| 1989 | 36 | 11 | 32 | 9 |
| 1990 | 37 | 11 | 37 | 12 |
| 1991 | 43 | 12 | 37 | 15 |

### Table 12

### NUEXCO EXCHANGE VALUE COMPARED TO SUPPLY-DEMAND RATIO IN 1982

| Month | Supply-Demand Ratio | Exchange Value |
|---|---|---|
| | (as of the last day of the month) | |
| January | 3.5 | $23.00 |
| February | 3.3 | 23.00 |
| March | 5.2 | 22.50 |
| April | 9.3 | 20.75 |
| May | 9.5 | 20.50 |
| June | 16.2 | 19.25 |
| July | 2.6 | 18.25 |
| August | 10.6 | 17.00 |
| September | 5.0 | 17.00 |
| October | 2.1 | 17.50 |
| November | 1.0 | 19.75 |
| December | 2.3 | 20.25 |

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B6800-1 A

# NUEXCO

JUNE 1983 NUMBER 178

# Monthly Report on the Nuclear Fuel Market

NUEXCO

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6/16/83
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# NUEXCO REPORT 178
## FIGURES OF THE MONTH
### (May 31, 1983)

| | This Month (Report 178) | Last Month (Report 177) | 12 Months Ago (Report 166) |
|---|---|---|---|
| Exchange Value[1] | 23.50 | 23.25 | 20.75 |
| Transaction Value[1] | 22.35 | 21.40 | 22.60 |
| Conversion Value[2] | 1.20 | 1.20 | 1.20 |
| Loan Use Charge Rate[3] | 6% | 6% | 6% |
| Near-Term Uranium Supply[4] | 5.9 | 8.6 | 13.0 |
| Near-Term Uranium Demand[5] | 3.1 | 2.6 | 1.4 |
| Near-Term Supply-Demand Ratio | 1.9 | 3.4 | 9.3 |
| Current Transactions[6]: | | | |
| Number of Transactions | 8 | 6 | 3 |
| Quantity of Material[7] | 0.4-1.2 | 7.6-12.8* | 0.7-1.4 |
| SWU Prices[8]: | | | |
| Nuexco SWU Values: | | | |
| FY 83 | none | 103 | — |
| FY 84 | 103 | 109 | — |
| USDOE SWU Prices: | | | |
| AFC | 138.65 | 138.65 | 130.75 |
| Requirements | 149.85 | 149.85 | 138.37 |
| Market Value of Enriched $UF_6$[9], [10]: | | | |
| 2.5 w/o $U_{235}$ | 619.44 | 616.52 | — |
| 3.0 w/o $U_{235}$ | 792.80 | 789.24 | — |
| 3.5 w/o $U_{235}$ | 969.24 | 965.04 | — |
| 4.0 w/o $U_{235}$ | 1,147.96 | 1,143.13 | — |

---

[1] US $ per pound $U_3O_8$ equivalent

[2] US $ per pound U as $UF_6$

[3] Per annum

[4] Active inquiries to sell, for delivery within 12 months after contract signing (millions of pounds $U_3O_8$)

[5] Active inquiries to purchase, for delivery within 12 months after contract signing (millions of pounds $U_3O_8$)

[6] Uranium sales only; does not include loans, conversion, or SWU transactions

[7] Millions of pounds $U_3O_8$, equivalent

[8] US $ per SWU

[9] Calculated using the Nuexco Exchange Value, Conversion Value, and 0.20 percent tails assay. Calculations before 2/28/83 used the USDOE price for AFC SWUs. As of 2/28/83, calculations use the Nuexco SWU Value for the relevant fiscal year (currently FY 84).

[10] US $ per KgU as $UF_6$

*Correction of last month's arithmetic error.

## INDEX TO LAST MONTH'S REPORT (176)

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# EXECUTIVE SUMMARY
## REPORT 178

**Exchange Value Rose $0.25, to $23.50**

The **Exchange Value** as of May 31, 1983 is **$23.50** per pound $U_3O_8$. Seven spot or near-term uranium sales are reported, involving approximately 600 thousand pounds $U_3O_8$, *equivalent.*

**Supply Demand Ratio Declined to 1.9:1**

**Active** spot and near-term **uranium supply** amounts to **5.9** million pounds $U_3O_8$, *equivalent*, down 30% from last month. **Active** spot and near-term **uranium demand** rose 20%, to **3.1 million** pounds $U_3O_8$ equivalent. Therefore, the spot and near-term **supply-demand ratio** declined 30 percent, to**1.9:1.**

**Transaction Value Rose $0.95, to $22.35**

The **Transaction Value** as of May 31, 1983, is **$22.35** per pound $U_3O_8$. It includes 16 transactions involving a total of 2.1 million pounds $U_3O_8$, equivalent and covers a period of four months.

**Conversion Value unchanged at $1.20**

The **Conversion Value** as of May 31, 1983 is **$1.20** per pound U as $UF_6$, unchanged since last month. No secondary market conversion transactions are reported. Active sellers are offering 7.0 million pounds U in conversion services for delivery in the next three years. Active secondary market demand for conversion services, for delivery in the next three years, amounts to 1.8 million pounds U. Active supply remains approximately four times active demand.

**Loan Use Charge Rate Steady at 6%**

The **Loan Use Charge Rate** as of May 31, 1983 is **6 percent** per annum. No loan transactions are reported.

**SWU Values: FY 83 Discontinued**

Nuexco has discontinued the SWU Value for FY 83 due to the lack of activity in the secondary market for FY83 SWU deliveries.

**FY 84 $103, down $6**

As of May 31, 1983 the **SWU Value for FY 84** is **$103 per SWU**, down $6 from last month. This segment of the market is the most active at present. The market for FY 85 and beyond remains quiet. However, some buyers will probably be entering the market for FY85 SWUs in the near future.

**Australia**

Labor Party struggles with conflicts between Left Wing ideology and the realities of international politics.

**Belgium**

Government acquired 50% interest in Synatom.

**Canada**

Background and analysis of recently stiffened federal government insistence on "upgrading" to $UF_6$ all Canadian uranium exports.

**France**

Controversial government report recommends cutbacks in national nuclear program.

**Germany, Federal Republic**

Nuclear environment has improved during past year.

**Spain**

Proposed cancellation of five reactors threatens national nuclear power plans.

**United States**

1. Duke Power Co. officially cancelled Cherokee Unit 1, its sixth such cancellation in the past 14 months.
2. Consumers Power Co. delayed its two Midland nuclear units by 13 to 14 months each.
3. Lack of approved evacuation plans could lead to several reactor shutdowns as the issue takes on increasing importance.
4. Energy Information Administration (EIA) moving rapidly to prepare annual report on "viability of domestic uranium mining and milling industry."

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NUEXCO

# MONTHLY REPORT ON THE URANIUM MARKET

June 1983 No.178

R. WESLEY MILLER, *EDITOR*

*PRICING*

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## FOREWORD

We are pleased to announce that Mr. **Earl E. Hoellen, Jr.** will be joining Nuexco's Northeast United States office as a Regional Marketing Manager. Earl will assist Ken McCue in our uranium brokerage operations.

Earl comes to Nuexco from Westinghouse Electric Corporation, where he was involved in the marketing of steam generator services. Earl was previously employed at Duke Power Company, where he was Assistant Manager of Nuclear Fuel Purchases for the past 4 years. Prior to that, Earl was Vice President and Project Manager at Western Fuel, Inc. He holds a B.S. in nuclear engineering from the University of Virginia, and an M.B.A. from the University of North Carolina.

* * *

Mr. **J. Robert Wolcott** addressed the General Electric 1983 Fuel Conference in Hilton Head, South Carolina on May 9. A copy of his speech is enclosed with this Report.

## NATURAL URANIUM AND CONVERSION

The **Exchange Value** as of May 31, 1983 rose for the eighth consecutive month, to **$23.50** per pound $U_3O_8$, up $0.25 since last month. The *Current Market Data* section of this Report lists eight uranium sales transactions, none of which involved more than 300 thousand pounds $U_3O_8$, *equivalent*. The total was 0.4 to 1.2 million pounds $U_3O_8$; the seven spot or near-term transactions accounted for approximately 600 thousand pounds $U_3O_8$.

**Active spot and near-term uranium supply** ($U_3O_8$ or natural $UF_6$ offered at competitive prices, terms, and other conditions) amounts to **5.9 million** pounds $U_3O_8$ equivalent, down 30 percent from last month's level of 8.6 million. **Active spot and near-term uranium demand** rose 20 percent, to **3.1 million** pounds $U_3O_8$, equivalent. Therefore, the spot and near-term **supply-demand ratio** declined to **1.9:1**, 44 percent lower than last month's level of 2.6.

* * *

The **Transaction Value** as of May 31, 1983, is **$22.35** per pound $U_3O_8$, equivalent, an increase of $0.95 since last month. The current Transaction Value includes 16 transactions involving a total of 2.1 million pounds equivalent, and covers a period of four months.

* * *

The **Conversion Value** as of May 31, 1983 is **$1.20** per pound U as $UF_6$, unchanged from last month. No secondary market conversion transactions are reported this month. In reporting *active* supply and demand for secondary market conversion services, Nuexco has replaced the former interval of "within one year" (spot and near-term) with a three-year interval, in order to more accurately reflect the way participants in this market are behaving.

**Active supply** of secondary market conversion services (active inquiries to sell secondary market conversion services for delivery within the next *three* years) totals **7.0 million** pounds U. Similarly, **active demand** for secondary market conversion services amounts to **1.8 million** pounds U.

The ratio of secondary market conversion supply and demand is **3.9:1**. That key ratio is essentially the same as last month's corresponding ratio, derived using the one-year interval.

* * *

The **Loan Use Charge Rate** remained at six percent per annum. Nuexco is aware of at least three lenders holding a total of more than three million pounds available for loan as $U_3O_8$ at 6 percent per annum, but there are few potential borrowers. No loan transactions are reported this month.

* * *

The **Exchange Value's** eighth consecutive monthly increase is attributable more to a continuation of the trend of recent months than to substantial upward price pressure. The prices of the relatively small amounts traded—seven spot or near-term transactions averaging less than 100 thousand pounds $U_3O_8$, equivalent—justified the $0.25 increase in the Exchange Value, but one or two large transactions could have had a substantially larger impact in either direction. Although the preponderance of bids, offers and transactions lie within the range from $22.50 to $24.50, potential buyers for substantial quantities are exercising a high degree of discretion, and most sellers holding large lots are holding firmly to their offering prices. The result is a market poised for a renewed surge of activity. Whether that will lead to rising, dropping or stable prices remains to be seen.

## ENRICHED URANIUM AND SWUS

As of May 31, 1983 Nuexco has discontinued the **SWU Value for FY 1983**, due to the virtual absence of activity in the secondary market for SWU deliveries. In fact, there have been no recent secondary market SWU sales for FY 1983 delivery.

DOE, because of heavy commitments at the end of fiscal year 1983, will not allow potential sellers to make changes to their 180 day enrichment order of quantities and tails assays to be delivered. Buyers seeking DOE SWU for FY 1983 delivery must find a seller who has already ordered the desired enrichment assay, or who has such an assay in inventory. Likewise, sellers of Eurodif-origin SWUs cannot guarantee FY 1983 delivery of enriched material of the assay desired by a buyer, particularly if export and import of the enriched material to the buyer's country for fabrication is required.

As of May 31, 1983 the **SWU Value for FY 1984** is **$103** per SWU, down $6 since last month. The relatively large price drop, 5.5 percent in a market that is typically much less volatile than the uranium market, reflects the dominance of the market by sellers of large quantities of

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## PRICING

Eurodif-origin SWUs. They continue to price aggressively in their efforts to induce holders of DOE requirements-type contracts having 3.5-year termination provisions to terminate (or partially terminate) those contracts and purchase replacement SWUs on the secondary market.

Previously, these sellers were willing to offer prices near $110 per SWU, a level which was attractive only to the large block of potential buyers who, requiring deliveries in June-August, 1984, were thus able to terminate with more than 1 year's notice. Recently, however, the strong competition among sellers for a declining number of buyers, has increased downward pressue on prices. Furthermore, DOE has given customers indications that henceforth it will use the midpoint of FY 1984 (April 1, 1984) as the assumed date of a terminated delivery for requirements contract terminators buying non-DOE SWUs. Thus, in order to attract buyers who must pay termination charges based on less than one year's notice (25 percent rather than the 20 percent associated with 1-2 years' notice), sellers of Eurodif-origin SWUs have been offering at approximately $103 per SWU for FY 1984 delivery.

The secondary SWU market for FY 1985 and later remains quiet, as it has for the past several months. Potential sellers continue to await DOE's announcement of the terms and conditions of conversion to the FR (Facility Requirements) contract. That announcement had been expected in late April or early May, but has been delayed at least until late July or early August. However, some buyers will probably be entering the market for FY85 SWUs in the near future. Sellers will probably quote to them in terms of a discount to be applied to AFC SWU prices.

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*CURRENT MARKET DATA*

**EXCHANGE VALUE \$23.50/lb. $U_3O_8$**
Determined as of May 31, 1983

**Definition**[1]

The Exchange Value is Nuexco's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the last day of the month.

**Derivation**

Nuexco bases the Exchange Value upon:

A. Data from recently completed transactions.
B. Data from pending transactions.
C. Firm bids to buy and firm offers to sell.
D. Prices purchasers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy, and prices sellers have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell.

**Comments**

Nuexco does not consider the following in determining the Exchange Value:

A. The price of uranium delivered or to be delivered under old contracts.
B. The price of uranium delivered in connection with contract renegotiations or other than arm's length transactions.

---

[1] In December, 1981, Nuexco published a history of the Exchange Value which chronicled, month-by-month, changes in its definition, usage and derivation. Copies are available upon request.

**TRANSACTION VALUE**[2]
Determined as of May 31, 1983

| \$/lb. $U_3O_8$ | Millions of Pounds | Number of Transactions | Number of Months |
|---|---|---|---|
| 22.35 | 2.1 | 16 | 4 |

**Definition**

The Transaction Value is a weighted average price of recent transactions, and is based on prices paid for $U_3O_8$ in transactions closed within the previous three-month period and for which delivery was scheduled within one year of the transaction date. At least ten transactions totaling at least two million pounds $U_3O_8$ are included in each calculation, or the sample time is extended as necessary to include these minima. Foreign currencies are converted to US dollars as of the transaction date.

**Comments**

Nuexco does not consider the following in determining the Transaction Value:

A. The price of uranium delivered in connection with contract renegotiations or other than arm's length transactions.
B. The price of uranium delivered in connection with contracts which call for "market price" mechanisms. This exclusion applies particularly to contracts in which delivery prices are expressed as a function of Exchange Value or any other independent variable. Also excluded from consideration are all data where the delivery price is defined in such a way that it cannot currently be determined.

---

[2] Transaction Values for 1976 through 1981 and their associated parameters (millions of pounds, number of transactions and number of months) are tabulated on pages 31 and 32 of Report 161. Corresponding data for 1982 are tabulated on page 5 of Report 173.

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*CURRENT MARKET DATA*

**CONVERSION VALUE[1] $1.20/lb. U as $UF_6$**
Determined as of May 31, 1983

**Definition**

The Conversion Value is Nuexco's judgment of the price at which spot and/or near-term transactions for significant quantities of conversion services could be concluded in the secondary market as of the last day of the month.

**Derivation**

Nuexco bases the Conversion Value upon:

A. Data from recently completed transactions.
B. Data from pending transactions.
C. Firm bids to buy and firm offers to sell.
D. Prices purchasers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy, and prices sellers have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell.

**Comments**

Nuexco does not consider the following in determining the Conversion Value:

A. The price of conversion services delivered or to be delivered under old contracts.
B. The price of conversion services delivered in connection with contract renegotiations or other than arm's length transactions.

[1] Monthly data for 1981 and 1982 are tabulated on page 6 of Report 173.

**LOAN USE CHARGE RATE[2] 6%**
Determined as of May 31, 1983

**Definition**

The Loan Use Charge Rate is Nuexco's judgment of the annual interest rate at which uranium loans could be concluded as of the last day of the month.

**Derivation**

Nuexco bases the Loan Use Charge Rate upon:

A. Data from recently completed or pending loan transactions.
B. Rates included in firm proposals to borrow or lend.
C. Rates that potential borrowers and lenders have expressed as a willingness to pay or accept, but for which Nuexco is not aware of firm proposals.

[2] Monthly data for 1968 through 1981 appear on pages 32-34 of Report 162. Monthly data for 1982 appear on page 2 of Report 173.

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## CURRENT MARKET DATA

**SWU VALUE $103/SWU for FY84**
Determined as of May 31, 1983

### Definition

The SWU (Separative Work Unit) Value is Nuexco's judgment of the price, expressed in US dollars per SWU, at which transactions for the sale of significant quantities of SWU of any origin for delivery in the specified DOE fiscal year could be concluded as of the last day of the month.

### Derivation

Nuexco bases the SWU Value upon:

A. Data from recently completed transactions.
B. Data from pending transactions.
C. Firm bids to buy and firm offers to sell.
D. Prices purchasers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy, and prices sellers have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell.
E. SWU prices at varying tails assays and varying product assays are converted to the equivalent SWU price at the DOE Reference Transaction Tails Assay (presently 0.20 weight percent $U_{235}$) and a product assay of three percent $U_{235}$ assuming feed costs calculated using the Nuexco Exchange Value and Nuexco Conversion Value determined as of the last day of the same month.

### Comments

Nuexco does not consider the following in determining the SWU Value:

A. The price of SWU delivered under long-term contracts from primary suppliers, such as DOE, Urenco, or Eurodif.
B. The price of SWU delivered under other than arm's length transactions.

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*CURRENT MARKET DATA*

## EXCHANGE VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

| Country (currency) | per lb. $U_3O_8$ in Concentrates | per kg $U_3O_8$ in Concentrates | per kg U in Concentrates |
|---|---|---|---|
| Australia (dollar) | 26.60 | 58.65 | 69.17 |
| Belgium (comm. franc) | 1,181 | 2,603 | 3,070 |
| Canada (dollar) | 28.90 | 63.71 | 75.13 |
| Finland (markka) | 128.63 | 283.57 | 334.40 |
| France (franc) | 176.96 | 390.12 | 460.05 |
| FRG (mark) | 59.02 | 130.11 | 153.43 |
| Italy (lira) | 35,075 | 77,326 | 91,186 |
| Japan (yen) | 5,589 | 12,321 | 14,529 |
| Netherlands (guilder) | 66.44 | 146.48 | 172.73 |
| South Africa (rand) | 25.28 | 55.73 | 65.71 |
| Spain (peseta) | 3,264 | 7,196 | 8,485 |
| Sweden (krona) | 176.69 | 389.54 | 459.36 |
| Switzerland (franc) | 48.88 | 107.76 | 127.07 |
| UK (pound) | 14.65 | 32.29 | 38.08 |
| US (dollar) | 23.50 | 51.81 | 61.09 |

## TRANSACTION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

| Country (currency) | per lb. $U_3O_8$ in Concentrates | per kg $U_3O_8$ in Concentrates | per kg U in Concentrates |
|---|---|---|---|
| Australia (dollar) | 25.30 | 55.78 | 65.78 |
| Belgium (comm. franc) | 1,123 | 2,476 | 2,920 |
| Canada (dollar) | 27.48 | 60.59 | 71.45 |
| Finland (markka) | 122.33 | 269.69 | 318.04 |
| France (franc) | 168.30 | 371.03 | 437.54 |
| FRG (mark) | 56.13 | 123.74 | 145.92 |
| Italy (lira) | 33,358 | 73,542 | 86,724 |
| Japan (yen) | 5,315 | 11,718 | 13,818 |
| Netherlands (guilder) | 63.19 | 139.31 | 164.28 |
| South Africa (rand) | 24.04 | 53.00 | 62.50 |
| Spain (peseta) | 3,104 | 6,844 | 8,070 |
| Sweden (krona) | 168.05 | 370.48 | 436.88 |
| Switzerland (franc) | 46.49 | 102.48 | 120.85 |
| UK (pound) | 13.93 | 30.71 | 36.21 |
| US (dollar) | 22.35 | 49.27 | 58.11 |

[1] Calculated using currency exchange rates published in the Wall Street Journal on May 31, 1983.

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*CURRENT MARKET DATA*

## CONVERSION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

| Country (currency) | per lb. U as $UF_6$ | per kg U as $UF_6$ |
|---|---|---|
| Australia (dollar) | 1.36 | 3.00 |
| Belgium (comm. franc) | 60.30 | 132.94 |
| Canada (dollar) | 1.48 | 3.25 |
| Finland (markka) | 6.57 | 14.48 |
| France (franc) | 9.04 | 19.92 |
| FRG (mark) | 3.01 | 6.64 |
| Italy (lira) | 1,791 | 3,949 |
| Japan (yen) | 285.37 | 629.14 |
| Netherlands (guilder) | 3.39 | 7.48 |
| South Africa (rand) | 1.29 | 2.85 |
| Spain (peseta) | 166.67 | 367.44 |
| Sweden (krona) | 9.02 | 19.89 |
| Switzerland (franc) | 2.50 | 5.50 |
| UK (pound) | 0.75 | 1.65 |
| US (dollar) | 1.20 | 2.65 |

## SWU VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

| Country (currency) | FY 1984 per SWU |
|---|---|
| Australia (dollar) | 116.61 |
| Belgium (comm. franc) | 5,176 |
| Canada (dollar) | 126.66 |
| Finland (markka) | 563.77 |
| France (franc) | 775.60 |
| FRG (mark) | 258.66 |
| Italy (lira) | 53,731 |
| Japan (yen) | 24,495 |
| Netherlands (guilder) | 291.21 |
| South Africa (rand) | 110.79 |
| Spain (peseta) | 14,306 |
| Sweden (krona) | 774.44 |
| Switzerland (franc) | 214.23 |
| UK (pound) | 64.19 |
| US (dollar) | 103.00 |

[1] Calculated using currency exchange rates published in the Wall Street Journal on May 31, 1983.

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*CURRENT MARKET DATA*

## TRANSACTION SUMMARY[1]

### Uranium Transactions

| Nuexco Transaction Number | Delivery Period | Approximate Quantity (thousands of pounds, $U_3O_8$ equivalent) | Approximate Price as Percent of Current E.V. | Seller | Buyer | Remarks |
|---|---|---|---|---|---|---|
| 2306 | 1983 | 101-300 | indeterminate | European Entity | European Utility | Barter for $UF_6$ |
| 2320 | 1983 | 50-100 | indeterminate | US Producer | European Utility | |
| 2327 | 1983 | 101-300 | 97 | US Utility | Unknown | $UF_6$ |
| 2335 | 1983 | Less than 50 | 100 | European Utility | US Producer | |
| 2349 | 1983 | 50-100 | 99 | European Entity | US Producer | $UF_6$ |
| 2349 | 1985 | 101-300 | 99 | European Entity | US Producer | |
| 2353 | 1983 | Less than 50 | 100 | European Utility | US Producer | |
| 2354 | 1983 | Less than 50 | 104 | European Utility | US Producer | |

### Conversion Transactions

| Nuexco Transaction Number | Delivery Period | Approximate Quantity (thousands of pounds, U equivalent) | Approximate Price as Percent of Current C.V. | Seller | Buyer | Remarks |
|---|---|---|---|---|---|---|

There are no conversion transactions reported this month.

### Loan Transactions

| Nuexco Transaction Number | Delivery Period | Approximate Quantity (thousands of pounds, $U_3O_8$ equivalent) | Approximate Price as Percent of Current L.U.C.R. | Lender | Borrower | Remarks |
|---|---|---|---|---|---|---|

There are no loan transactions reported this month.

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[1] Transactions listed are not limited to those in which Nuexco was involved but also include others of which Nuexco is aware.

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## URANIUM SUPPLY
## (As of 5/31/83)

| Nuexco Project Number | Delivery Period[1] (Thousands of Pounds $U_3O_8$) Spot or Near-term[2] | Intermediate or Long-term[3] | Remarks |
|---|---|---|---|
| **Available for Sale:** | | | |
| **ACTIVE** | | | |
| 1575 | | 500 per year | Long Term |
| 1818 | | 250 per year | Long Term |
| 2017 | | 2,300 | |
| 2038 | 2,000 | | $UF_6$ |
| 2056 | 1,800 | | $UF_6$ |
| 2134 | | 300 per year | 1984 on |
| 2162 | 130 | | Primarily $UF_6$ |
| 2191 | 125 | | $UF_6$ |
| 2193 | | 800 per year | 1986-90 |
| 2201 | 30 | | |
| 2203 | 1,200 | | |
| 2219 | 200 | | Enriched $UF_6$ |
| 2235 | | 100 per year | 1985-87 |
| 2245 | 200 | 100 per year | 1984-88 |
| 2271 | | 500 per year | 1984-88 |
| 2275 | 80 | | |
| 2294 | 125 | | $U_3O_8$ and $UF_6$ |
| TOTAL: | 5,890 | | |
| **INACTIVE** | | | |
| 1877 | 115 | | |
| 2246 | 40 | 100 | |
| TOTAL: | 155 | | |

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[1] Measured from the date of this Report

[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

[3] For delivery beyond one year.

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*CURRENT MARKET DATA*

## URANIUM DEMAND
(As of 5/31/83)

| Nuexco Project Number | Delivery Period[1] (Thousands of Pounds $U_3O_8$) | | Remarks |
|---|---|---|---|
| | Spot or Near-term[2] | Intermediate or Long-term[3] | |
| **Inquiries to Purchase:** | | | |
| **ACTIVE** | | | |
| 1871 | | 250 per year | 1984-86 |
| 1996 | 400 | | |
| 2010 | | 400 per year | 1984-92 |
| 2042 | 600 | 1,400 | 1986-90 |
| 2061 | 15 | | |
| 2115 | | 200 per year | 1985 on |
| 2167 | 250 | 250 + per year | 1984-99 |
| 2187 | 50 | | |
| 2188 | | 300 per year | 1985 on |
| 2206 | 200 | | Enriched $UF_6$ |
| 2214 | 400 | | $UF_6$ |
| 2217 | 900 | 500 per year | 1984-95 |
| 2244 | | 350 per year | 1985 on |
| 2252 | 325 | | $UF_6$ |
| TOTAL: | 3,140 | | |
| **INACTIVE** | | | |
| 1459 | | 200 per year | Long Term |
| 1888 | | 400 per year | Long Term |
| 1999 | | 50 per year | 1985-90 |
| 2025 | | 350 | |
| 2269 | 250 | | |
| 2270 | 175 | | |
| TOTAL: | 425 | | |

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[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

[3] For delivery beyond one year.

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## CONVERSION SUPPLY
(As of 5/31/83)

| Nuexco Project Number | Delivery Period[1] (Thousands of Pounds U as $UF_6$) Within 3 Years | Beyond 3 Years | Remarks |
|---|---|---|---|
| **ACTIVE** | | | |
| 1609 | 1,500 | | |
| 1840 | 130 | | |
| 1936 | 1,500 | 200 per year | Long Term |
| 2051 | 1,500 | | |
| 2141 | 1,500 | | |
| 2143 | 400 | | |
| 2220 | 400 | | |
| 2222 | 100 | 175 | |
| TOTAL: | 7,030 | | |
| **INACTIVE** | | | |
| 2008 | 800 | 800 | |
| 2181 | 650 | 650 per year | Long Term |
| TOTAL: | 1,450 | | |

## CONVERSION DEMAND
(As of 5/31/83)

| Nuexco Project Number | Delivery Period[1] (Thousands of Pounds U as $UF_6$) Within 3 Years | Beyond 3 Years | Remarks |
|---|---|---|---|
| **ACTIVE** | | | |
| 2129 | 900 | | |
| 2135 | 400 | 135 per year | 1986-87 |
| 2199 | 450 | 300 per year | 1986 on |
| TOTAL: | 1,750 | | |
| **INACTIVE** | | | |
| 2190 | 400 | 200 per year | 1986 on |
| 2194 | | 300 per year | 1986 on |
| 2295 | 250 | | |
| TOTAL: | 650 | | |

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[1] Measured from the date of this Report.

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*CURRENT MARKET DATA*

## LOAN SUPPLY AND DEMAND
(As of 5/31/83)

| Nuexco Project Number | Delivery Period[1] (Thousands of Pounds $U_3O_8$) Within 1 Year | Beyond 1 Year | Remarks |
|---|---|---|---|
| **Available for Loan:** | | | |
| **ACTIVE** | | | |
| 1938 | 1,500 | | $UF_6$ |
| 2121 | 600 | | |
| 2128 | 2,500 | | |
| 2205 | 300 | | |
| TOTAL: | 4,900 | | |
| **INACTIVE** | | | |
| 1815 | 1,000 | | $UF_6$ |
| 1884 | 600 | | |
| 2036 | 500 | | $UF_6$ |
| 2040 | 600 | | $UF_6$ |
| 2139 | 2,000 | | |
| TOTAL: | 4,700 | | |
| **Inquiries to Borrow:** | | | |
| **ACTIVE** | | | |
| 1998 | 200 | 200 | |
| 2006 | 600 | | |
| 2118 | 250 | | $U_3O_8$ or $UF_6$ |
| TOTAL: | 1,050 | | |
| **INACTIVE** | None | | |

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[1] Measured from the date of this Report

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## AUSTRALIA

Australia's governmental policies on uranium marketing and nuclear safeguards are characterized by confusion arising from the conflict between Left Wing ideology on the one hand and practical politics on the other. For example, the government has granted Energy Resources of Australia (ERA) and Queensland Mines, Ltd. (QML) new licenses to negotiate uranium supply contracts. In theory, these new licenses have freed both companies to respond to current market opportunities. However, the granting of licenses to negotiate new contracts might be construed to conflict with the ALP (Australian Labor Party) platform provisions calling on an ALP government to phase out the industry (*presumably* meaning to support the fulfillment of existing contracts while prohibiting new developments).

While the government grapples with one of its thorniest political problems, the uranium companies find themselves in a tenuous marketing position. Until prospective buyers receive reasonable assurances that new contracts will be honored by the ALP government, ERA and QML will find it difficult to represent themselves as reliable suppliers under new contracts. On the other hand, if they wait for the ALP to resolve its stance on the issue, they may miss some opportunities for sales.

The conflict between Left Wing ideology and practical politics was also behind the seemingly contradictory behavior of Australia's Foreign Minister, Mr. Hayden, while in Paris to attend the IAEA meeting. On the one hand, Mr. Hayden expressed Australian support for the development of standard, international safeguards for the use, storage, and monitoring of uranium for peaceful purposes. At the same time, the former ALP leader strongly protested against French nuclear weapons testing at the Mururoa Atoll in the Pacific Ocean. In his protest he reiterated the ALP platform stance by proposing an Australian ban on uranium sales to France unless the tests were discontinued.

Respondents to Hayden's protest, however, made it clear that such a ban would not only be seen in Europe as an action against France, but that sales of other Australian commodities in the European market such as coal and agricultural products would in turn be affected. Consequently, following the IAEA meeting Mr. Hayden endorsed a communique stressing the importance of stable trade in nuclear equipment, fuel cycle services and nuclear fuel. The European reaction is a factor the ALP will not be able to ignore in the development of a practicable uranium policy.

Having heeded the Europeans' warnings that an uncompromising position would seriously endanger Australian trade in general, the government has undertaken to review its policy through several committees. In practical terms, the outcome will indicate to what degree the party platform can be modified in order for the government to maintain Australia's international reputation as a reliable supplier of resources. In the meantime, Mr. Hawke has let it be known that he will treat French military testing of nuclear weapons and Australian uranium exports to France as two separate issues during his upcoming meetings in France.

* * *

There are those within the ranks of the ALP who would advocate a more active role for Australia in nuclear matters on the basis of Australia's large uranium reserves. They reason that, if Australia could become a promoter of safeguards, including the safe burial of civil nuclear wastes, and at the same time contest military uses and weapons testing, it would reduce opposition to uranium mining and export within the labor movement.

Presently, the Australian government is reviewing its bilateral safeguards agreements. Although it will take some time before the review is concluded, Australia should be prepared for bitter resistance from the EEC (European Economic Community) and Japan, should a tougher position be taken, especially as certain points of disagreement put aside for the original agreements still exist. Until the review is complete, however, Australian uranium exports under existing contracts will continue.

* * *

Western Mining Corp. (WMC) will likely scrap the Yeelirrie uranium project if no progress is made this year to launch it. Developers have spent 30 million dollars on the project since it was discovered 13 years ago by WMC and its former joint venture partners. Since Esso's withdrawal from the project in 1982, WMC has unsuccessfully sought a new partner. French interests were explored, but the advent of new Australian political leadership foreclosed the possibility of a French uranium partnership, at least for the immediate future.

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*RECENT DEVELOPMENTS*

## CANADA

In last month's Report [#177, pg. 13], mention was made of the Canadian government's apparent decision to informally strengthen the implementation of its so-called "upgrading" policy requiring the export of natural uranium in the form of $UF_6$ whenever possible. This policy decision is undoubtedly based on the desire to utilize the full capacity of Eldorado's new Port Hope conversion facility. Furthermore, its timing reflects the confidence associated with the considerable success Canadian uranium sellers have enjoyed during the past few years.

The observed reaction of utilities, particularly those in the USA, has been one of resisting the purchase of $UF_6$ if conversion services have been contracted previously. This resistance has been evident even when an economic case can be made for the purchase of $UF_6$; i.e. when the sum of existing conversion costs plus the cost of $U_3O_8$ is greater than the sum of $UF_6$ purchase cost plus any costs associated with the cancellation or renegotiation of existing conversion commitments.

The success of the Canadian government's action depends on the belief that economics will prevail. The secondary SWU market, the development of which has been totally based on economics; provides an example in support of that belief.

To date, US utilities have not exhibited such economically rational behavior regarding the purchase of $UF_6$. On the contrary, it is clear that a number of Canadian sales during the past few years would not have been concluded had an inflexible upgrading policy been in place. Furthermore, there are recent cases where insistence on upgrading has, in fact, resulted in lost sales. While this situation could reverse and parallel the SWU market, there are several reasons why such a reversal seems unlikely.

First, the relationship between utility and converter is quite different than that which exists between utility and DOE. The former relationship is typically characterized by long-term personal associations and experience in working out commercial problems. The competitive conversion market has demanded flexibility. In contract, DOE's relationship to its utility customers has been that of a government monopoly, as indicated by DOE's decisions to alter its enrichment contracts by fiat as opposed to negotiation.

Secondly, in the secondary SWU market the economic advantage is immediately quantifiable. Such is not the case in the $UF_6$ vs. $U_3O_8$ plus conversion decision. Even if $UF_6$ looks cheap today, there is concern about what might happen to prices in the future, particularly should the Canadian government elect to re-involve itself in pricing matters.

Accordingly, it seems unlikely that the market will witness any significant cancellation of existing conversion agreements in order to purchase $UF_6$. The available market, then, is reduced to those utilities having uncovered conversion needs. In the USA, due to the number of reactor cancellations and delays which have already necessitated stretchouts and renegotiations of conversion commitments, there are few utilities with such needs. Thus, an inflexible upgrading policy is likely to result in a slowdown in the penetration of the US uranium market by Canadian sellers. An interesting consequence of such a development could be a reduction of the pressure within the US uranium industry for protection from imports.

## EUROPE

### Belgium

On April 28, 1983, the state acquired a 50 percent share in Synatom, the nuclear fuel procurement and management company serving the country's nuclear power industry in Belgium. To accomplish this, the Synatom capital shares were doubled, and the new shares were wholly subscribed by the Societé Nationale d'Investissement (SNI), a government entity.

The private shareholders of the company remain (current shareholding shown in parentheses): EBES (20 percent); Intercom (20 percent) and Unerg (10 percent). The change does not affect the existing obligations of the company. However, the presence of government representatives on the board of directors could, to a limited extent, increase the company's influence on government policy decision, and vice versa.

### France

In **France**, a government commissioned report on energy policy, scheduled for review in June, is creating a lot of international interest. Portions of the report "leaked" to newspapers in Europe concluded that, although the nation does not *need* to order any more nuclear units for the next nine years, France should order one 1,300 MWe unit during each of the next seven years in order to sustain the French nuclear manufacturing infrastructure. The newspapers' accompanying pessimistic commentary on France's nuclear future has generated much controversy, particularly because most members of the working group charged to prepare the study have repudiated its conclusions.

The French program, which had a net capacity of 2,508 MWe in 1973, went through a dramatic growth phase in the years following the Arab oil embargo. Nuclear units comprising 4,540 MWe began operations in 1980 and 8,990 MWe began operations in 1981. The requirements of these plants alone account for over 4 million pounds of $U_3O_8$ per year. Formerly, optimistic projections of growth in electricity demand had produced a forecast of approximately three to five new nuclear units per year until 1990.

If the report's conclusions, as presently stated, are enacted by the government, France's installed nuclear generating capacity as of 1990 would be 6,000 MWe lower than the current forecast. Moreover, future orders from Framatome might be reduced to one 1,300 MWe unit per year. Although the report implies that such a level of orders would be sufficient to sustain France's nuclear manufacturing capability, manufacturers have already challenged that conclusion vigorously and publicly.

It would be inappropriate to discuss the impact on uranium procurement before the government completes its update of national energy policy. At that time, high-case and low-case scenarios can be constructed for the effect on uranium demand for the largest uranium consuming body in the free world, Électricité de France (EdF). Although the direction of the report's conclusions was indicated by an interim report issued some seven months ago, the furor has led the author, Mr. Noel Josephe, to offer to write a so-called "final" report, including opposing points of view. The final report might be released this summer.

**Federal Republic of Germany**

The nuclear environment in the **Federal Republic of Germany (FRG)** has improved over the past year. While there still exists a considerable amount of opposition to nuclear power, there are tangible signs that the FRG program as a whole is moving forward. The Brokdorf nuclear power plant, once feared to be headed for an indefinite deferral, is now under construction. The plant, owned jointly by Nordwestdeutsche Kraftwerke (NWK) and Hamburgische Electricitaetswerke (HEW), is tentatively scheduled for a 1986 or 1987 completion date. Similarly, the reprocessing plant at Dragahn has received approval to commence construction. Dragahn is located near Gorleben, which only a few years ago was rejected as a site for a reprocessing facility, primarily on political grounds. In addition, the controversial fast breeder (SNR-300) and high temperature (THTR-300) prototype reactors have received the requisite funding from the FRG government — financial support which had previously been withheld.

Chancellor Helmut Kohl has stated publicly his strong support for nuclear power, and the coalition government of the Christian Democrats (CDU) and the Free Democrats (FDP) can be expected to reflect this position in its actions. It is interesting to note however, that during the recent elections, the Greens, a party known for its anti-nuclear stance, received only 5.1 percent of the vote in regions where nuclear facilities were located, as opposed to a national average of 5.6 percent. It appears then, that nuclear power might be declining in importance as a political issue.

Although the outlook for nuclear power in the FRG seems more positive than it has in the recent past, nuclear utilities still face certain problems. As in the USA, FRG utilities have experienced significantly lower load growth rates than had been expected. At a time when capital for new construction is scarce, critics of nuclear power are raising the question of whether new plants are actually needed at all. This argument is further supported by the fact that strong government support for the domestic coal industry effectively prohibits utilities from replacing coal-fired plants with new, cheaper nuclear plants in their base load. Certain utilities that are now paying upwards of US dollars 50.00 to 100.00 per metric ton of domestic coal would find it economical to replace their coal-fired units with nuclear generating units, but are frustrated by both governments' backing of the coal industry and critics' insistence that they justify the need for additional generating capacity.

From a commercial standpoint, the improved climate for nuclear power should mean that the sharp build-up of utility inventories will ease, and begin to reverse itself over the next few years. This may be quite important in terms of the potential impact on the spot market for uranium. If the FRG nuclear units were to continue

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*RECENT DEVELOPMENTS*

being delayed or cancelled, it is possible that utility spot sales might begin to increase as the ratio of inventory to anticipated future demand would prompt some utilities to liquidate their inventories in order to reduce their carrying costs. The potential impact of such an event may be measured by examining the role that spot sales by US utilities played in the price decline of 1980-1982. It now seems unlikely that FRG utilities will be forced to take similar actions. Unfortunately, however, FRG uranium stocks are sufficiently high that there is little unfilled uranium demand in the 1980s, even if one uses optimistic assumptions regarding plants under construction and planned. While advocates of nuclear power may take pleasure in the current political situation in the FRG, uranium suppliers will have to wait for some time to enjoy the full benefits.

### Spain

The major role nuclear power was to play in **Spain**'s energy future has been threatened by the proposed cancellation of 5 Spanish reactors. The units in question, Valdecaballeros Units 1 and 2, Trillo Units 1 and 2, and Vandellos Unit 2, represent 4,926 MWe and could account for 42 percent of Spain's nuclear energy capacity by 1990.

This proposed change in energy policy, recently announced by Carmen Mestre, Spain's Energy Director, could dramatically alter the projected future for nuclear power in that country. If such a cancellation were to take place, Spain's uranium requirements would be sverely reduced, effective almost immeidately. As Trillo Unit 1, Valdecaballeros Unit 1 and Vandellos Unit 2 had been scheduled for 1986 start-up, with initial core requirements occurring in 1984, Spain's 1984 uranium requirements would drop by 56 percent. These proposed cancellations would reduce 1985 requirements demand by 20 percent, with a cumulative reduction of 30 to 47 percent to be expected through 1990.

If the proposed cancellations are enacted, ENUSA (Empresa Nacional de Uranio, SA.), the state-owned uranium supply organization, will have to readjust uranium supplies. Presently, Spanish uranium supplies come from several long-term contracts with Africa and Canada. Only 10 percent of known supplies are of domestic origin. A cancellation of the five planned units would not only reduce Spain's requirements, but would give ENUSA the opportunity to replace foreign supply contracts with domestic ones. Spain then would need only increase production at its pilot scale production facility in the Cuidad Rodrigo region (present capacity 250,000 pounds $U_3O_8$ per year) and develop the Molina de Aragon and Don Benito deposits in order for ENUSA to supply 90 percent of the nation's annual uranium requirements domestically by 1988. By 1990, Spain could reach an annual 2.5 million pounds $U_3O_8$, enough to supply 100 percent of the reduced requirements domestically.

Currently, some of Spain's foreign supply contracts are scheduled to end in the mid-1980s. These deliveries could be terminated early and would have little further effect on the Spanish supply program. At a time when the new Spanish government is reviewing its finances, it will be interesting to see how ENUSA absorbs or adjusts its uranium inventories over the next few years in response to the Spanish government's reactor cancellation policy.

## SOUTH AFRICA

A tonnage-weighted index has been adopted by the Chamber of Mines' quarterly publication, *Analysis of Working Results*. In previous analyses of the average working costs per ton milled, comparisons of results from different times were made by means of a simple ratio, adjusted by the percentage change in the consumer price index. Such logic is misleading unless a tonnage-weighted index is used to calculate the percentage increase in working cost per ton milled. This is in order to eliminate the influence on the average of new mines entering production and changes in the rate of tons milled by certain mines.

The index is based on the "Laspyres Method" and the formula used is as follows:

$$\text{Index} = \frac{\Sigma TM_0 \times CT_1}{\Sigma TM_0 \times CT_0}$$

where: $TM_0$ = Tons milled in previous quarter
$CT_0$ = Cost per ton milled in previous quarter
$CT_1$ = Cost per ton milled in current quarter

Figures for each quarter of 1982 are now recorded in the *Government Statistics* section of this Report (footnoted on the South Africa page) and further data will be reported when available.

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## UNITED STATES

### Reactor Cancellation and Delays

Duke Power Company has cancelled the construction of Unit 1 at their Cherokee Nuclear Station. Located in Gaffney, South Carolina, this station had been initially intended for three pressurized water reactors (PWR) designed by Combustion Engineering for 1,280 MWe (net) each. With the earlier cancellation of all three units at the Perkins Nuclear Station (North Carolina) and the 1982 cancellation of Units 2 and 3 at the Cherokee Nuclear Station, Duke Power Company has now cancelled six nuclear units in the past 14 months.

At present, Duke Power operates 4 PWRs comprising a total rated output of 3,760 MWe (net). Current utility forecasts indicate their intention to bring three additional units (3,470 MWe) to commercial operation between the fourth quarter of 1983 and year-end 1987.

* * *

As a result of site reinspection and rework, Consumers Power Company announced in March that both nuclear units at the Midland Nuclear Station in Michigan would be delayed for a few months. A revised schedule presented at the utility's annual meeting indicated delays of 13 to 14 months, moving the fuel loading dates to October 1984 for Unit 2 and February 1985 for Unit 1. Once in commercial operation, the two units will increase consumers' generating capacity by 1,335 MWe (net). Further delays are likely.

* * *

### Emergency Planning Regulations

The criteria listed in Nureg-0654 require the implementation of an emergency evacuation plan for the zone located within a 10-mile radius around any nuclear reactor. The evacuation zone, defined in Nureg-0654, is based on source terms established by the NRC and there is some disagreement with some utilities over the degree to which those terms are overstated. However, the NRC staff does not plan to propose regulation changes for at least a year.

Indian Point Units 2 and 3, operated by Consolidated Edison and the Power Authority of the State of New York, have become the focal points of this issue. Acting as a consultant to the NRC, the Federal Emergency Management Agency (Fema) has already condemned two evacuation drills at Indian Point and the NRC has issued a third warning. Progress is being made towards solving emergency evacuation inconsistencies in New York's Westchester and Rockland Counties, but it is unlikely that solutions will be in place by June 9 — the NRC decision date for shutdown or continued operation of the station. The utilities expect that the progress made, however little, will at least allow for the continued operation of Indian Point. A decision to shut down would creat a precedent with far-reaching effects. State and local governments would be allowed to shut down nuclear reactors simply by abstaining from emergency planning.

Long Island Lighting's Shoreham Unit is inextricably linked to this issue also. This is one unit for which emergency planning problems appear insurmountable. The specific configuration of the plant in addition to its location, an island, have made workable emergency evacuation plans practically inconceivable.

The outcome of the Indian Point issue will have far-reaching implications for utilities and local governments with plants presently under construction. Administrators who have plants that might be susceptible to similar emergency planning problems may give this issue priority early on in the planning and construction of nuclear power plants. In particular, units that will probably develop *extensive* emergency plans will be Public Service of New Hampshire's Seabrook station, Philadelphia Electric's Limerick plant, and Cincinnati Gas and Electric's Zimmer plant.

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*ANALYSIS AND COMMENTARY*

## UPDATE ON US IMPORT LIMITATION EFFORTS

The Energy Information Administration (EIA) is rapidly moving to fulfill the Secretary of Energy's obligations to monitor and report annually to Congress and the President on the viability of the domestic uranium mining and milling industry. Those obligations arose as a result of Senator Domenici's otherwise unsuccessful efforts late last year to enact a limitation on US uranium imports [Nuexco Monthly Report #174, pg. 25].

The EIA will soon hold public hearings, probably in New Mexico and Wyoming, as a prelude to the promulgation by October 4, 1983 of rules defining the criteria by which that viability will be determined. The enabling legislation specifies certain criteria that must be addressed in detail. Many of those criteria are reminiscent of "Section 202" reviews submitted annually to the Joint Committee on Atomic Energy (JCAE) by the former Atomic Energy Commission. However, the JCAE's unique congressional role in promoting the development of nuclear power was abolished in 1977. The EIA has made a major effort to assemble the required industry and market data for the study, prompting the question of how realistic it is to establish viability criteria before the first round of reports have been reviewed by the public, the Congress and the President.

Likewise, a major EIA policy analysis tool requires the design and testing of a computer model to simulate the inter-relationships between uranium demand production and pricing. Finding useful market data, fitting it to the model, and gaining confidence in its predictability may strain the reporting time frame currently envisioned. Judging from current trends, there are five fundamental perceptions of the market that will have particular importance for the upcoming EIA hearings.

1. In general, reduced demand for US production is unrelated to the percentage of uranium imports. US production declines are the direct reflection of reactor deferrals and cancellations which have reduced earlier demand projections by almost 50 percent. Increased load growth, reduced construction time and licensing predictability are the principal factors which would most directly increase the fundamental demand for uranium.

2. Although reduced demand has been reflected in the renegotiation of existing agreements, with delivery deferrals in some cases and termination of deliveries in others, there appears to be little evidence that US commitments are being abrogated in favor of non-US replacements. Rather than terminate their supply contracts completely, utilities have either stockpiled the material not needed or sold it on the spot market. Those excesses have been and remain the primary obstacles to the development of new, long-term contracts.

3. Inventory redistribution has dominated the coverage of unfilled requirements over the past two years. The spot market price has declined in direct response to the liquidation of excesses. What must be considered is that producer demand plays a significant role in the raising of spot prices. This is due to the producers' fulfillment of long-term contracts by means of spot market purchases in place of production. Producers worldwide have been reluctant to make long-term commitments on the basis of current spot prices, although those who have been willing to do so have been successful in concluding contracts. Likewise, many utilities have deferred making long-term commitments in favor of short-term spot purchases. Therefore, Nuexco believes it unlikely that long-term demand will strongly revive before the inventory overhang is reduced to a more acceptable level.

4. Various projections of rising spot prices suggest that the market price formulas utilized in recent long-term contracts (both US and non-US) may soon approach the price levels required by many US producers. Once this level is reached, at least one vital market measure of domestic industry viability will be evident. The Australian floor price is above this level and is not generally seen to be a threat to US production. Other indicators of the industry's viability such as security of supply, contract flexibility, and producer reputation will be demonstrated through the traditional contracting process. By the time any import limitations imposed within the current framework could take effect, the recovery of the uranium market might have already taken place. In that event, any such limitations might serve primarily to restrict the options available to US utilities, rather than to alter the course of the US industry's development.

5. The nuclear fuel cycle is not widely believed to need protection for national security interests, so efforts to enact an import limitation arelikely to gain favor with the public. Reserves are well defined in the USA. Mine and mill capacity (operating and in reserve) is more than adequte to meet projected demand. The USA is now, and while under free market conditions, will continue to be less dependent on imports than other major consum-

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ers of uranium. In Nuexco's opinion, US inventories and international secondary market sources are adequate to bridge any supply disruption until existing or new facilities can be brought back into production. In addition, that perception is widespread throughout the marketplace. Currently, concerns over potential supply disruptions are mitigated by the absence of a supplier's cartel outside the USA. Finally, close trading ties already exist with Australia, Canada, and South Africa, and uranium trading is viewed as one of the many relationships the USA shares with these partners. Historically then, these countries have been viewed as allies rather than as threats to national security.

No matter what viability criteria are established by the Secretary of Energy, the President will mandate what compromise is necessary before a trade barrier will be imposed. Determinations made by the US International Trade Commission that imports may be causing serious injury, or Commerce Department findings that national security may be threatened, will be weighed against State Department opposition to the unilateral imposition of import controls by the USA.

President Reagan, as Chairman of the Ninth Economic Summit which just convened in Williamsburg, Virginia, pushed for strong anti-protectionist language against trade barriers. His leadership was accepted by the other representatives of the seven largest industrial democracies who participated. There was a strong commitment to halt imposition of new trade barriers and remove those that already exist as recovery proceeds. The President's strong opposition to the original embargo legislation that failed in the House last fall and his avowed opposition to trade barriers as elements of US international policy and leadership suggest that a ban on uranium imports into the USA is unlikely.

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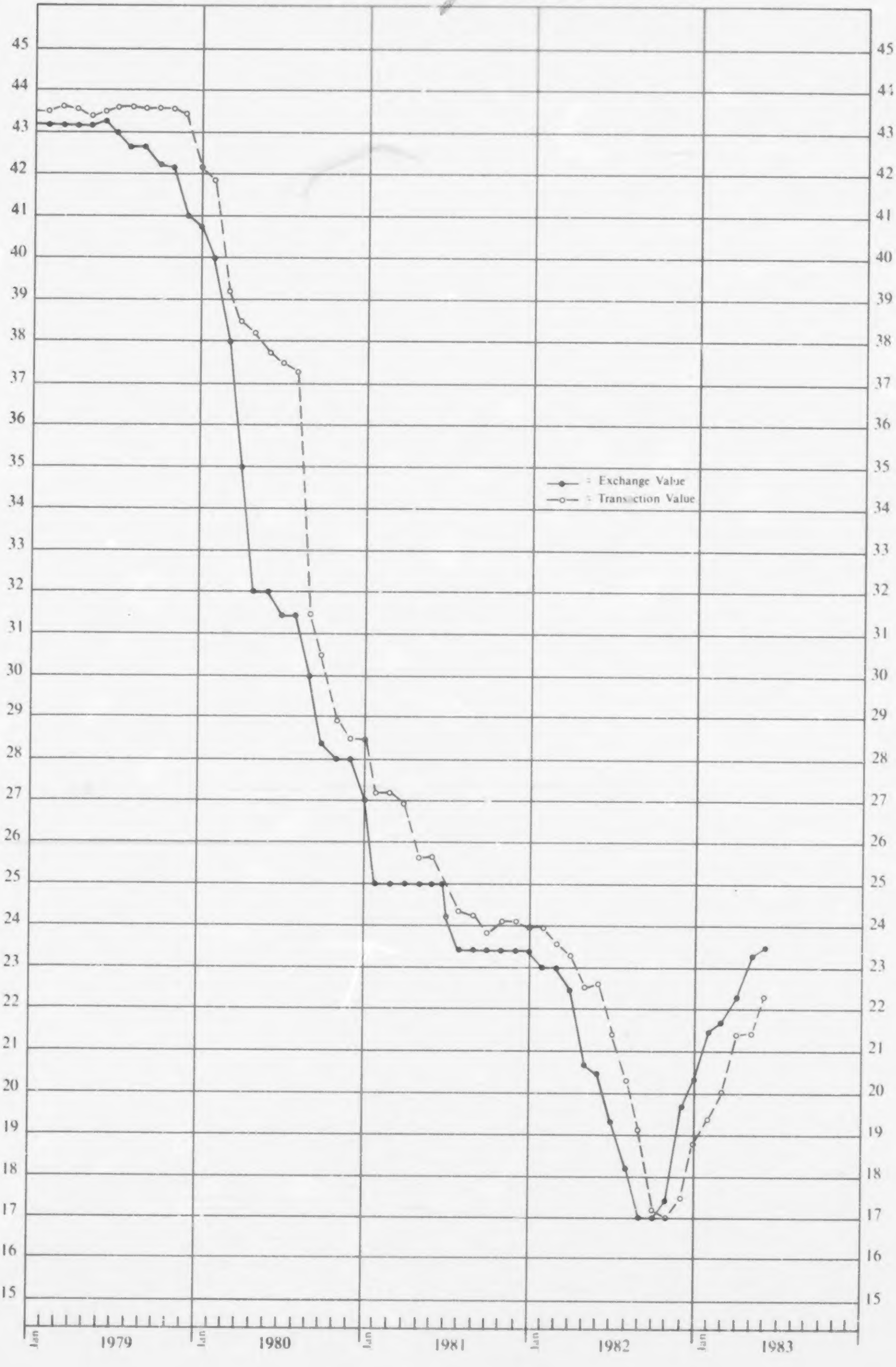
*HISTORICAL MARKET DATA*

## EXCHANGE AND TRANSACTION VALUES SINCE JANUARY 1979

Determined as of the last day of the month indicated



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## HISTORICAL EXCHANGE VALUES

Determined as of the last day of the month indicated (US Dollars/lb. $U_3O_8$)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1968 | — | — | — | — | — | — | — | 6.35 | 6.35 | 6.40 | 6.45 | 6.50 |
| 1969 | — | 6.35 | 6.10 | 6.10 | 6.25 | 6.25 | 6.20 | 6.20 | 6.15 | 6.15 | 6.15 | 6.20 |
| 1970 | 6.30 | 6.30 | 6.30 | 6.30 | 6.30 | 6.30 | 6.30 | 6.20 | 6.15 | 6.15 | 6.15 | 6.15 |
| 1971 | 6.20 | 6.20 | 6.20 | 6.20 | 6.15 | 6.05 | 6.00 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 |
| 1972 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 |
| 1973 | 5.95 | 6.00 | 6.10 | 6.20 | 6.45 | 6.50 | 6.50 | 6.50 | 6.50 | 6.50 | 6.75 | 7.00 |
| 1974 | 7.70 | 7.90 | 8.00 | 9.00 | 9.50 | 10.50 | 11.50 | 12.00 | 12.50 | 14.00 | 14.75 | 15.00 |
| 1975 | 16.00 | 16.00 | 18.00 | 20.00 | 21.00 | 23.00 | 24.70 | 26.00 | 26.00 | 28.50 | 30.00 | 35.00 |
| 1976 | 35.20 | 37.00 | 39.25 | 40.00 | 40.00 | 40.00 | 40.00 | 40.40 | 41.00 | 41.00 | 41.50 | 41.00 |
| 1977 | 41.35 | 41.50 | 41.60 | 41.60 | 42.00 | 42.25 | 42.25 | 42.25 | 42.40 | 42.75 | 43.20 | 43.20 |
| 1978 | 42.90 | 43.25 | 43.25 | 43.25 | 43.40 | 43.40 | 43.40 | 43.10 | 43.25 | 43.00 | 43.25 | 43.25 |
| 1979 | 43.25 | 43.25 | 43.25 | 43.25 | 43.25 | 43.00 | 42.70 | 42.70 | 42.20 | 42.20 | 41.00 | 40.75 |
| 1980 | 40.00 | 38.00 | 35.00 | 32.00 | 32.00 | 31.50 | 31.50 | 30.00 | 28.50 | 28.00 | 28.00 | 27.00 |
| 1981 | 25.00 | 25.00 | 25.00 | 25.00 | 25.00 | 24.25 | 23.50 | 23.50 | 23.50 | 23.50 | 23.50 | 23.50 |
| 1982 | 23.00 | 23.00 | 22.50 | 20.75 | 20.50 | 19.25 | 18.25 | 17.00 | 17.00 | 17.50 | 19.75 | 20.25 |
| 1983 | 21.50 | 21.75 | 22.25 | 23.25 | **23.50** | | | | | | | |

## HISTORICAL TRANSACTION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. $U_3O_8$)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1976 | — | — | — | — | 39.60 | 39.70 | 39.70 | 40.40 | 40.30 | 40.60 | 40.70 | 40.70 |
| 1977 | 41.30 | 41.30 | 41.40 | 41.50 | 42.80 | 42.90 | 43.00 | 42.60 | 42.50 | 42.80 | 42.90 | 42.90 |
| 1978 | 43.10 | 43.30 | 43.70 | 43.60 | 43.60 | 43.20 | 43.30 | 43.40 | 43.40 | 43.60 | 43.40 | 43.70 |
| 1979 | 43.60 | 43.80 | 43.70 | 43.40 | 43.60 | 43.70 | 43.70 | 43.60 | 43.60 | 43.60 | 43.50 | 42.30 |
| 1980 | 42.00 | 39.30 | 38.60 | 38.40 | 37.90 | 37.60 | 37.30 | 31.60 | 30.60 | 29.00 | 28.70 | 27.70 |
| 1981 | 27.20 | 27.20 | 27.00 | 25.70 | 25.70 | 24.50 | 24.40 | 24.30 | 23.90 | 24.10 | 24.10 | 24.00 |
| 1982 | 24.00 | 23.70 | 23.40 | 22.60 | 22.70 | 21.50 | 20.30 | 19.10 | 17.30 | 17.00 | 17.55 | 18.80 |
| 1983 | 19.35 | 20.00 | 21.35 | 21.40 | **22.35** | | | | | | | |

## HISTORICAL CONVERSION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. $U_6$)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1981 | 1.20 | 1.20 | 1.20 | 1.40 | 1.15 | 1.15 | 1.15 | 1.10 | 1.10 | 1.10 | 1.20 | 1.20 |
| 1982 | 1.20 | 1.20 | 1.20 | 1.20 | 1.00 | 1.00 | 1.00 | 0.90 | 1.10 | 1.60 | 1.45 | 1.45 |
| 1983 | 1.20 | 1.40 | 1.40 | 1.20 | **1.20** | | | | | | | |

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## *GOVERNMENT STATISTICS*

### AUSTRALIA

| | Price Index of Materials Used in Manufacturing Industry—All Groups (Year 1968-69 = 100.0)[1] | Award Rates of Pay Indexes Australia—Adult Males In Mining Wage Earners, Weekly Rates (Year 1976 = 100.0)[2] |
|---|---|---|
| Annual Avg. 1972[3] | 105.6 | 71.26 |
| Annual Avg. 1973[3] | 124.4 | 78.96 |
| Annual Avg. 1974[3] | 141.9 | 108.07 |
| Annual Avg. 1975[3] | 150.4 | 132.55 |
| Annual Avg. 1976[3] | 168.4 | 160.93 |
| Annual Avg. 1977[3] | 192.0 | 179.03 |
| Annual Avg. 1978[3] | 198.5 | 190.04 |
| Annual Avg. 1979 | 248.8 | 196.34 |
| Annual Avg. 1980 | 321.8 | 218.00 |
| Annual Avg. 1981 | 355.3 | 237.34 |
| Annual Avg. 1982 | 367.9 | — |
| Dec 1981 | 349.9 | 167.6[2] |
| Jan 1982 | 354.9 | 169.3R[2] |
| Feb 1982 | 356.7 | 171.1[2] |
| Mar 1982 | 360.3 | 171.4R[2] |
| Apr 1982 | 367.7 | 171.4R[2] |
| May 1982 | 367.6 | 171.9R[2] |
| Jun 1982 | 367.2 | 173.2[2] |
| Jul 1982 | 369.1 | 177.2R[2] |
| Aug 1982 | 371.5 | 178.1R[2] |
| Sep 1982 | 374.0 | 178.2R[2] |
| Oct 1982 | 377.2 | 178.3R[2] |
| Nov 1982 | 374.5 | 178.4R[2] |
| Dec 1982 | 373.7 | 179.4R[2] |
| Jan 1983 | 386.6R | 179.1R[2] |
| Feb 1983 | 387.4P | 179.0[2] |

P = Preliminary    R = Revised since last month

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[1] Australian Bureau of Statistics, Canberra: "Price Index of Materials Used in Manufacturing Industry" (Catalogue No. 6411.0), Table 3.

[2] Australian Bureau of Statistics, Canberra: "Award Rates of Pay Indexes, Australia" (Catalogue No. 6312.0), Table 8. Figures are being converted to an Index number. As the data are converted, the new index numbers will be inserted. Figures for the latest fourteen months shown are subject to revision.

[3] Monthly data for 1970 through 1978 appear on pages 4.7 and 4.8 of Nuexco Report 138.

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## CANADA

| | Industry Selling Price Index: Manufacturing (D 500000)[1] [2] (1971 = 100.0) | Wage-earner Data: Average Hourly Earnings (C$)[4] [5] | | |
|---|---|---|---|---|
| | | Metal Mining, including Milling (SIC 050-099)[3] | Primary Metal Industries, non-ferrous (SIC 296-298) | Chemicals and Chemical Products (SIC 370-379) |
| Annual Avg. 1979 | 217.9 | 9.66 | 7.35 | 7.67 |
| Annual Avg. 1980 | 247.2 | 10.80 | 8.05 | 8.50 |
| Annual Avg. 1981 | 288.7 | 12.23 | 9.03 | 9.53 |
| Annual Avg. 1982 | 288.8P | 13.92 | — | 10.63 |
| Feb 1982 | 283.5 | 13.61 | 9.60 | 10.19 |
| Mar 1982 | 284.8 | 13.74 | 9.62 | 10.35 |
| Apr 1982 | 287.7 | 13.81 | 9.79 | 10.48 |
| May 1982 | 288.8 | 13.86 | 9.88 | 10.62 |
| Jun 1982 | 289.7 | 13.83 | 9.92 | 10.69 |
| Jul 1982 | 290.3 | 14.02 | 10.05 | 10.73 |
| Aug 1982 | 290.3 | 14.23 | 10.03 | 10.80 |
| Sep 1982 | 292.4 | 14.01 | 10.18 | 10.73 |
| Oct 1982 | 292.1 | 13.89R | 10.18 | 10.86 |
| Nov 1982 | 291.3 | 14.28R | 10.43 | 10.90 |
| Dec 1982 | 292.3 | 14.32R | 10.55R | 11.06R |
| Jan 1983 | 292.6 | 14.47R | 10.72R | 11.06R |
| Feb 1983 | 293.4 | 14.12P | 10.58P | 11.02P |
| Mar 1983 | 295.2R | — | — | — |
| Apr 1983 | 296.0 | — | — | — |

P = Preliminary    R = Revised since last month

[1] Statistics Canada, Prices Division, Ottawa: "Industry Price Indexes" (Catalogue 62-011), Table 1. Indexes for the most recent six months shown are subject to revision.

[2] Monthly data for 1973 through 1978 appear on page 4.10 of Nuexco Report 138.

[3] The wage earner series in Nuexco reports prior to March 1983 was Metals (SIC 050-059).

[4] Statistics Canada, Labour Division, Employment and Payrolls Section, Ottawa: "Employment, Earnings and Hours" (Catalogue 72-002), Table 2.

[5] Monthly data for 1977 and 1978 appear on page 4.11 of Nuexco Report 138.

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## *GOVERNMENT STATISTICS*

### REPUBLIC OF SOUTH AFRICA

| | Average Declared Working Costs per Metric Ton of Gold Ore Milled (Rand)[1] | Consumer Price Index[2] (1975 = 100, except where otherwise indicated) | Producer[5] Price Index All Groups (1975 = 100) | Total Employment in Mining and Quarrying (Code 35)[7] | Total Salaries and Wages in Mining and Quarrying (1,000 Rand) (Code 40)[7] |
|---|---|---|---|---|---|
| Annual Avg. 1971[3] | 7.88 | 106.4[4] | 59.1 | 652,294 | 415,956 |
| Annual Avg. 1972[3] | 8.79 | 113.3[4] | 63.9 | 623,067 | 443,933 |
| Annual Avg. 1973[3] | 10.51 | 124.1[4] | 72.3 | 684,743 | 572,133 |
| Annual Avg. 1974[3] | 13.18 | 138.5[4] | 85.3 | 674,140 | 761,596 |
| Annual Avg. 1975[3] | 16.71 | 157.2[4] | 100.0 | 639,473 | 1,003,617 |
| Annual Avg. 1976[3] | 19.30 | 174.7[4] | 115.1 | 671,240 | 1,212,983 |
| Annual Avg. 1977[3] [6] | 23.87 | 194.4[4] | 130.0 | 712,006 | 1,420,670 |
| Annual Avg. 1978[3] [6] | 27.14 | 137.2 | 142.7 | 664,571 | 1,537,169 |
| Annual Avg. 1979[3] [6] | 30.18 | 155.3 | 164.5 | 692,209 | 1,830,632 |
| Annual Avg. 1980[6] | 35.53 | 176.7 | 192.1 | 714,379 | 2,279,615 |
| Annual Avg. 1981 | 41.89 | 206.5 | 218.3 | 728,506 | 2,820,505 |
| Nov 1981 | — | 214.8 | 229.4 | 720,255 | 253,044 |
| Dec 1981 | 44.52 | 216.3 | 230.4 | 709,612 | 257,655 |
| Jan 1982 | — | 217.6 | 233.1 | 700,375 | 257,173 |
| Feb 1982 | — | 220.2 | 236.8 | 705,992 | 250,191 |
| Mar 1982 | 45.49 | 225.2 | 237.4 | 725,700 | 262,210 |
| Apr 1982 | — | 228.9 | 241.9 | 707,502 | 252,562 |
| May 1982 | — | 230.3 | 244.8 | 715,162 | 258,770 |
| Jun 1982 | 45.77 | 232.1 | 246.7 | 707,552 | 261,361 |
| Jul 1982 | — | 234.1 | 249.4 | 702,141 | 283,248 |
| Aug 1982 | — | 236.8 | 253.4 | 705,562 | 276,730 |
| Sep 1982 | 48.04 | 241.0 | 255.0 | 704,344 | 282,782 |
| Oct 1982 | — | 243.9 | 260.1 | 701,316 | 285,328 |
| Nov 1982 | — | 245.4 | 262.5 | 707,966 | 287,699 |
| Dec 1982 | 49.62 | 246.2 | 263.0 | 683,982 | 288,019 |
| Jan 1983 | — | 249.0 | 264.9 | — | — |
| Feb 1983 | — | 253.1 | 267.4 | — | — |
| Mar 1983 | 50.35 | 255.9 | 269.1 | — | — |
| Apr 1983 | — | 257.8 | — | — | — |

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[1] Chamber of Mines of South Africa, Johannesburg; "Analysis of Working Results," published quarterly. The tonnage-weight index of average working costs per metric ton of gold ore milled for 1982 is as follows. See text on page 16 for the description and calculation.

| 1982: | | |
|---|---|---|
| 1982: | January-March | 100.0 |
| | April-June | 100.9 |
| | July-September | 106.0 |
| | October-December | 109.7 |

[2] Republic of South Africa Department of Statistics, Pretoria; "Government Gazette: Consumer Price Index for Urban Areas."

[3] Historical data for the Average Declared Working Costs and Consumer Price Index 1970-1979 appear on page 4.9 of Nuexco Report 140.

[4] April 1970 = 100.00.

[5] Previously known as the WHOLESALE PRICE INDEX, now the PRODUCER PRICE INDEX. The computation remains the same.

[6] Historical data for Codes 35 and 40 1977-1980 appear on page 28 of Nuexco Report 157.

[7] Bulletin of Statistics, Department of Statistics, Pretoria.

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## UNITED STATES

| | Producer Price Index— Industrial Commodities (1967 = 100)[1] | Producer Price Index— All Commodities (1967 = 100)[1] | Consumer Price Index (1967 = 100)[2] | GNP Implicit Price Deflator (1972 = 100)[3] | Gross Average Hourly Earnings of Production or Non-supervisory Workers (US$)[4] | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Metal Mining (SIC 10) | Primary Non-ferrous Metals (SIC 333) | Chemicals and Allied Products (SIC 28) | Electric and Electronic Equipment (SIC 36) |
| Annual Avg. 1972[5] | 117.9 | 119.1 | 125.3 | 100.00 | 4.56 | 4.59 | 4.26 | 3.71 |
| Annual Avg. 1973[5] | 125.9 | 134.7 | 133.1 | 105.75 | 4.84 | 4.98 | 4.51 | 3.91 |
| Annual Avg. 1974[5] | 153.8 | 160.1 | 147.7 | 115.08 | 5.44 | 5.63 | 4.88 | 4.21 |
| Annual Avg. 1975[5] | 171.5 | 174.9 | 161.2 | 125.79 | 6.13 | 6.24 | 5.39 | 4.64 |
| Annual Avg. 1976[5] | 182.4 | 183.0 | 170.5 | 132.34 | 6.76 | 6.87 | 5.91 | 4.96 |
| Annual Avg. 1977[5] | 195.1 | 194.2 | 181.5 | 140.05 | 7.28 | 7.67 | 6.43 | 5.39 |
| Annual Avg. 1978[5] | 209.4 | 209.3 | 195.4 | 150.42 | 8.23 | 8.56 | 7.02 | 5.82 |
| Annual Avg. 1979[5] | 236.5 | 235.6 | 217.4 | 163.42 | 9.27 | 9.50 | 7.60 | 6.32 |
| Annual Avg. 1980[5] | 274.8 | 268.8 | 246.8 | 178.64 | 10.26 | 10.63 | 8.30 | 6.94 |
| Annual Avg. 1981 | 304.1 | 293.4 | 272.4 | 195.51 | 11.55 | 11.98 | 9.12 | 7.62 |
| Annual Avg. 1982 | 312.3P | 299.3P | 289.1 | 207.15 | 12.31 | 12.90 | 9.98 | 8.17 |
| Apr 1982 | 309.9 | 298.0 | 284.3 | — | 12.23 | 12.68 | 9.81 | 8.03 |
| May 1982 | 309.6 | 298.6 | 287.1 | — | 12.25 | 12.71 | 9.83 | 8.05 |
| Jun 1982 | 310.6 | 299.3 | 290.6 | 205.98 | 12.26 | 12.91 | 9.95 | 8.09 |
| Jul 1982 | 312.8 | 300.4 | 292.2 | — | 12.23 | 12.91 | 10.02 | 8.18 |
| Aug 1982 | 313.2 | 300.2 | 292.8 | — | 12.29 | 12.97 | 10.03 | 8.24 |
| Sep 1982 | 312.7 | 299.3 | 293.3 | 208.51 | 12.53 | 13.46 | 10.20 | 8.31 |
| Oct 1982 | 314.3 | 299.8 | 294.1 | — | 12.50 | 13.22 | 10.24 | 8.34 |
| Nov 1982 | 315.0 | 300.3 | 293.6 | — | 12.52 | 13.18 | 10.28 | 8.38 |
| Dec 1982 | 315.2R | 300.7R | 292.4 | 210.42 | 12.52 | 13.01 | 10.34 | 8.45 |
| Jan 1983 | 314.0P | 300.0P | 293.1 | — | 12.62 | 13.29 | 10.35 | 8.48 |
| Feb 1983 | 314.4P | 301.2P | 293.2 | — | 12.65 | 13.25R | 10.43R | 8.51R |
| Mar 1983 | 313.4P | 300.5P | 293.4 | 213.36P | 12.57P | 13.38P | 10.41R | 8.54R |
| Apr 1983 | 312.6P | 300.8P | 295.5 | — | — | — | 10.47P | 8.52P |

P = Preliminary    R = Revised since last month

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[1] US Bureau of Labor Statistics, Washington, D.C.; "Producer Prices and Price Indexes," Table 6 (formerly "Wholesale Prices and Price Indexes"). Producer Price Indexes are revised four months after they are first released to reflect the availability of late reports and corrections by respondents.

[2] US Bureau of Labor Statistics, Washington, D.C.; Consumer Price Index for All Urban Consumers, US City Average, All Items.

[3] US Department of Commerce, Washington, D.C.; Bureau of Economic Analysis, National Income and Wealth Division; "Survey of Current Business," Table A. The GNP Implicit Price Deflator is published quarterly, and seasonally adjusted.

[4] US Bureau of Labor Statistics, Washington, D.C.; "Employment and Earnings," Table C-2. All data based on 1972 revision of SIC Manual. Data for 1970-1976 are adjusted to the March 1977 benchmark. Data for 1977-1978 are adjusted to the March 1979 benchmark. Data for January 1979 and beyond are adjusted to the March 1980 benchmark.

[5] Monthly data 1970-1978 for Producer Price Index-Industrial Commodities, Consumer Price Index, and Employment and Earnings SIC codes 10, 333, and 28, and quarterly data for GNP Implicit Price Deflator appear on pages 4.6-4.8 of Nuexco Report 139.
Monthly data 1977-1978 for Employment and Earnings SIC Codes 10, 333, and 28 appear on page 33 of Nuexco Report 147.
Monthly data 1970-1978 for Employment and Earnings SIC Code 36 appear on page 23 of Nuexco Report 154.
Monthly data 1979-1980 for Employment and Earnings, Revised Establishment Data, all listed codes, appear on page 22 of Nuexco Report 158.
Monthly data 1977-1980 for Producer Price Index-All Commodities, appear on page 21 of Nuexco Report 158.

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7/23/83 B6800-1 A

# NUEXCO

JULY 1983 NUMBER 179

# Monthly Report on the Nuclear Fuel Market

NUEXCO

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(See inside back cover for list of Representatives and Consultants)

# EXECUTIVE SUMMARY
## REPORT 179

**Exchange Value Unchanged at $23.50**

The **Exchange Value** as of June 30, 1983 is **$23.50** per pound $U_3O_8$. Four spot or near-term uranium sales are reported, involving approximately 600 thousand pounds $U_3O_8$, *equivalent*. One transaction involved enriched $UF_6$, two involved $U_3O_8$, and the fourth involved natural $UF_6$ (plus SWUs in the longer-term portion).

**Supply-Demand Ratio Increased to 2.6:1**

**Active** spot and near-term **uranium supply** amounts to **6.0** million pounds $U_3O_8$, *equivalent*, approximately unchanged. **Active** spot and near-term **uranium demand** declined 25%, to **2.3** million pounds $U_3O_8$ equivalent. Therefore, the spot and near-term **supply-demand ratio** rose 37 percent, to **2.6:1**.

**Transaction Value Rose $0.10 to $22.45**

The **Transaction Value** as of June 30, 1983, is **$22.45** per pound $U_3O_8$. It includes 18 transactions involving a total of 2.4 million pounds equivalent $U_3O_8$ and covers a period of five months.

**Conversion Value Unchanged at $1.20**

The **Conversion Value** as of June 30, 1983 is **$1.20** per pound U as $UF_6$, unchanged since last month. No secondary market conversion transactions are reported. Active supply remains approximately four times active demand.

**Loan Use Charge Rate Steady at 6%**

The **Loan Use Charge Rate** as of June 30, 1983 is **6 percent** per annum. No loan transactions are reported.

**SWU Values: FY 84 $103, Unchanged**

As of June 30, 1983 the **SWU Value for FY84** is **$103 per SWU**, unchanged since last month, reflecting prices being offered by sellers of large quantities of Eurodif-origin SWUs. The few sellers of DOE-origin SWUs for FY84 delivery are offering in the range of $107-$110 per SWU. For FY85 delivery, some sellers are offering DOE-origin SWUs at a discount of approximately $15 from DOE's AFC price for FY85 and some are offering Eurodif-origin SWUs in the range of $110-$115 per SWU. However, the market for FY85 and beyond remains generally quiet, as buyers await DOE's announcement of the terms of conversion to the FR contract.

**SWU Transactions**

With this issue, Nuexco begins monthly reporting of recent transactions in the secondary SWU market.

**Analysis & Commentary**

US reactor cancellations are analyzed and units vulnerable to cancellation in the future are identified.

**Italy**

In the midst of a ten-year hiatus between start-ups of new nuclear power plants, Italy may have found a key to plant siting problems, but still lacks the sense of direction necessary to follow through on sound nuclear policy.

**Australia**

Uranium companies continue their efforts toward the development and marketing of uranium production in spite of obstacles presented by Labor Party policies.

**Focus: Japan**

Two aspects of Japan's nuclear power program stand out:
1. The desire to attain self-sufficiency throughout the fuel cycle.
2. Collectively, Japan's utilities own uranium inventories more than 100 million pounds equivalent $U_3O_8$ (in various forms up to and including $UO_2$) and are amply covered throughout the mid 1990s.

**United States**

1. Florida Power & Light to receive operating license for St. Lucie Unit 2, scheduled to begin operations later this summer.
2. NRC assured Consolidated Edison that Indian Point Units 2 and 3 will not be shut down for lack of emergency plan.
3. Congress considering legislation that would amend Price-Anderson Act, removing the current ceiling on liability for nuclear power plant operations.
4. Financial problems continue to hinder construction of WPPSS nuclear projects.

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| NUEXCO REPORT 179<br>FIGURES OF THE MONTH<br>(June 30, 1983) | This Month (Report 179) | Last Month (Report 178) | 12 Months Ago (Report 167) |
|---|---|---|---|
| Exchange Value[1] | 23.50 | 23.50 | 19.25 |
| Transaction Value[1] | 22.45 | 22.35 | 21.50 |
| Conversion Value[2] | 1.20 | 1.20 | 1.00 |
| Loan Use Charge Rate[3] | 6% | 6% | 6% |
| Near-Term Uranium Supply[4] | 6.0 | 5.9 | 17.8 |
| Near-Term Uranium Demand[5] | 2.3 | 3.1 | 1.1 |
| Near-Term Supply-Demand Ratio | 2.6 | 1.9 | 16.2 |
| Recent Transactions[6]: | | | |
| Number of Transactions | 4 | 8 | 6 |
| Quantity of material[7] | 1.3-3.7 | 0.4-1.2 | 0.4-1.2 |
| Nuexco SWU Value[8]: | | | |
| FY 84 | 103 | 103 | — |
| USDOE SWU Prices[8]: | | | |
| AFC | 138.65 | 138.65 | 130.75 |
| Requirements | 149.85 | 149.85 | 138.37 |
| Market Value of Enriched $UF_6$[9, 10] | | | |
| 2.5 w/o $U_{235}$ | 619.44 | 619.44 | — |
| 3.0 w/o $U_{235}$ | 792.80 | 792.80 | — |
| 3.5 w/o $U_{235}$ | 969.24 | 969.24 | — |
| 4.0 w/o $U_{235}$ | 1,147.96 | 1,147.96 | — |

---

[1] US $ per pound $U_3O_8$ equivalent.

[2] US $ per pound U as $UF_6$.

[3] Per annum.

[4] Active inquiries to sell, for delivery within 12 months after contract signing (millions of pounds $U_3O_8$ equivalent).

[5] Active inquiries to purchace, for delivery within 12 months after contract signing (millions of pounds $U_3O_8$ equivalent).

[6] Uranium sales only; does not include loans, conversion, or SWU transactions.

[7] Millions of pounds $U_3O_8$, equivalent.

[8] US $ per SWU.

[9] Calculated using the Nuexco Exchange Value, Conversion Value, and 0.20 percent tails assay. Calculations before 2/28/83 used the USDOE price for AFC SWUs. As of 2/28/83, calculations use the Nuexco SWU Value for the relevant fiscal year (currently FY 84).

[10] US $ per KgU as $UF_6$.

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NUEXCO

# MONTHLY REPORT ON THE URANIUM MARKET

July 1983 No. 179

R. WESLEY MILLER, *EDITOR*

*PRICING*

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## FOREWORD

Nuexco is saddened by Maxie L. Anderson's recent death in a balloon crash. Chairman of Ranchers Exploration & Development Co., a company primarily known for work in gold, silver and copper, Maxie was one of the most innovative uranium marketing men in the business. Maxie was one of the first subscribers to the Nuexco Monthly Report and we enjoyed our association with him throughout the past 14-15 years. His ability to inspire his associates to achieve the levels of excellence that he too sought will be remembered by us all. We at Nuexco extend our sympathies to his family and colleagues. He will be missed.

* * *

Effective August 1, 1983 the time for release of the Nuexco Exchange Value and associated monthly market data will be changed to 12:01 AM (0001) California time on the first business day of the month, regardless of whether that day is a holiday in some parts of the world. The purpose of the change is to make the Exchange Value (and other pricing data, etc.) available to all customers during the same business day throughout the world. Our Asian and Australian customers will derive the most obvious benefits from this change, because the release time formerly used, 9 AM in New York, resulted in their receiving the Exchange Value, etc. well after their business day had ended.

In the event that a US holiday falls on the first business day of a given month, our representatives in other countries and our office in Europe will release the data on schedule. Any US customers desiring access to the Exchange Value, etc. may obtain it by calling our office in Europe. Our US offices will then release the data on the first US business day of the month.

* * *

Our customers can now contact Jerry Reaves in Nuexco's Atlanta office via telex. The number is 4611142; answerback is NUEX ATL.

* * *

As of August 1, 1983, Nuexco will begin transmitting monthly by telex *to all Category I subscribers* a summary of the most-requested current market data published in each month's Nuexco Report. Transmissions will take place as early as practicable on the first business day of each month. Please contact Wendy Boyden or Kathie Kuziel in our Menlo Park office to resolve any problems. For example, if you wish to insure timely receipt, you could contact Wendy or Kathie during July to verify your telex number. This service was received enthusiastically in a recent test, so we anticipate that our Category I subscribers will find it a welcome addition.

* * *

We are pleased to announce that, effective July 1, 1983, Wayne Fowler and Jim Vaughan have been elected Senior Vice Presidents of Nuexco, reflecting their years of contribution to the firm's success.

* * *

Last month, Report 178 of June 1983 contained a typographical error in the *Analysis and Commentary* article entitled, "Update on US Import Limitation Effects". In the second column, near the bottom of page 18, the first sentence of item 5 reads as follows:

"The nuclear fuel cycle is not widely believed to need protection for national security interests, so efforts to enact an important limitation are likely (sic) to gain favor with the public." The sentence should have indicated that those efforts are *unlikely* to gain favor, etc. Please correct your copies so as to prevent any unnecessary confusion.

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## NATURAL URANIUM AND CONVERSION

The **Exchange Value** as of June 30, 1983 is **$23.50** per pound $U_3O_8$, unchanged since last month. The *Current Market Data* section of this Report lists four uranium sales transactions, involving approximately 600 thousand pounds $U_3O_8$, *equivalent*. Those sales reflected the shift of the spot and near-term markets toward an integrated market involving natural $UF_6$, enriched $UF_6$ and enrichment services, as well as $U_3O_8$. One transaction involved enriched $UF_6$, two involved $U_3O_8$, and the fourth involved natural $UF_6$ (plus SWUs in the longer-term portion).

**Active spot and near-term uranium supply** ($U_3O_8$ or natural $UF_6$ offered at competitive prices, terms, and other conditions) amounts to **6.0 million** pounds $U_3O_8$ equivalent, approximately unchanged from last month. **Active spot and near-term uranium demand** declined 25 percent, to **2.3 million** pounds $U_3O_8$, equivalent. Therefore, the spot and near-term **supply-demand ratio** rose to 2.6:1, 37 percent higher than last month's level of 1.9.

The **Transaction Value** as of June 30, 1983, is **$22.45** per pound $U_3O_8$, equivalent, an increase of $0.10 since last month. The current Transaction Value includes 18 transactions involving a total of 2.4 million pounds $U_3O_8$ equivalent, and covers a period of five months.

* * *

The **Conversion Value** as of June 30, 1983 is **$1.20** per pound U as $UF_6$, unchanged from last month. No secondary market conversion transactions are reported this month.

**Active supply** of secondary market conversion services (active inquiries to sell secondary market conversion services for delivery within the next *three* years) totals **7.0** million pounds U. Similarly, **active demand** for secondary market conversion services amounts to **1.8** million pounds U. Active supply remains approximately four times active demand.

* * *

The **Loan Use Charge Rate** remained at **six percent** per annum. Nuexco is aware of at least three lenders holding a total of more than three million pounds available for loan as $U_3O_8$ at 6 percent per annum, but there are few potential borrowers. No loan transactions are reported this month.

* * *

Both the $U_3O_8$ and secondary conversion markets reflected a general lessening of activity by both buyers and sellers during June, as it led into a traditionally quiet time of the year. If past history holds true this year, market activity should begin to increase in early September.

## ENRICHED URANIUM AND SWUS

As of June 30, 1983 the **SWU Value for FY 1984 is $103 per SWU,** unchanged from last month. As has been the case for some months, this price reflects the prices offered by sellers of large quantities of Eurodif-origin SWUs. Most potential sellers of DOE-origin SWUs for FY 1984 delivery have withdrawn from the market while awaiting DOE's announcement of the terms and conditions of conversion of their AFC contracts to the FR (Facility Requirements) form. Those DOE-origin SWUs that are available are being offered in the range of $107-$110 per SWU. As has characterized the secondary market for enrichment services for some time, the largest block of potential buyers are those holders of DOE requirements-type contracts having 3.5 year termination provisions. Thus, they are the only buyers who are able to terminate existing enrichment obligations and buy replacement SWUs economically on the secondary market.

Activity in the secondary SWU market dropped dramatically during much of June due to the decision by a number of potential buyers (holders of DOE requirements-type contracts having 3.5 year termination provisions) to delay secondary market participation and attempt to negotiate price reductions directly with DOE. Negotiations involved an interim agreement, wherein DOE would waive termination charges and allow these customers to purchase SWUs directly from DOE at the fixed-commitment price of $138.65 per SWU rather than the requirements contract price of $149.65. Included in such an arrangement would have been the customers' agreements to convert their requirements contract to the FR contract when such contract was offered formally later this summer.

Those negotiations have just recently been temporarily suspended by top DOE officials, who decided such efforts were premature until DOE concludes its ongoing review of its enrichment marketing efforts. That review is not scheduled for completion until some months in the future. Therefore, those potential buyers are once again actively reviewing offers to sell SWU on the secondary market, and a number of large transactions are expected to occur shortly.

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The secondary market for FY 1985 and later remains quiet, as it has for the past few months. Many potential buyers, as well as most sellers of DOE-origin SWUs, continue to await DOE's announcement of the terms and conditions of conversion to the FR contract. That announcement is still expected in late July or early August. Active sellers of DOE-origin SWUs for FY 1985 delivery are offering at approximately $15 per SWU discount from DOE's AFC price for FY85 SWUs, yet to be announced. Prices offered by sellers of Eurodif-origin SWUs for FY 1985 delivery are in the range of $110 to $115 per SWU.

* * *

With this Report, Nuexco begins the monthly publication of summary data pertaining to recent transactions in the secondary SWU market. Appearing in the *Current Market Data* section, the data will be presented in a tabular form very similar to that used for uranium and conversion. Two aspects of the tabulation may need further explanation:

1. In reporting the delivery period, Nuexco will indicate, insofar as possible, the quarter(s) and calendar year(s), *not fiscal* year(s).
2. Choosing a price reference is difficult. In general, the price will vary according to delivery period, tails assay and origin of the SWUs. Nuexco has arbitrarily chosen to compare price to the current SWU Value. In months when Nuexco publishes more than one SWU Value, the one which is based on a delivery period nearest to the then-current Report date will be used. Also, Nuexco has arbitrarily chosen *not* to normalize prices to 0.2 percent tails assay (TA). Thus, in one sense, the prices are not at all comparable, as the SWU Value *does* refer to 0.2 percent TA. However, there is some evidence to suggest that market participants do not necessarily normalize prices to 0.2 percent TA either.

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## *CURRENT MARKET DATA*

**EXCHANGE VALUE $23.50/lb. $U_3O_8$**
Determined as of June 30, 1983

**Definition**[1]

The Exchange Value is Nuexco's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the last day of the month.

**Derivation**

Nuexco bases the Exchange Value upon:

A. Data from recently completed transactions.
B. Data from pending transactions.
C. Firm bids to buy and firm offers to sell.
D. Prices purchasers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy, and prices sellers have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell.

**Comments**

Nuexco does not consider the following in determining the Exchange Value:

A. The price of uranium delivered or to be delivered under old contracts.
B. The price of uranium delivered in connection with contract renegotiations or other than arm's length transactions.

---

[1] In December, 1981, Nuexco published a history of the Exchange Value which chronicled, month-by-month, changes in its definition, usage and derivation. Copies are available upon request.

**TRANSACTION VALUE**[2]
Determined as of June 30, 1983

| $/lb. $U_3O_8$ | Millions of Pounds | Number of Transactions | Number of Months |
|---|---|---|---|
| **22.45** | 2.4 | 18 | 5 |

**Definition**

The Transaction Value is a weighted average price of recent transactions, and is based on prices paid for $U_3O_8$ in transactions closed within the previous three-month period and for which delivery was scheduled within one year of the transaction date. At least ten transactions totaling at least two million pounds $U_3O_8$ are included in each calculation, or the sample time is extended as necessary to include these minima. Foreign currencies are converted to US dollars as of the transaction date.

**Comments**

Nuexco does not consider the following in determining the Transaction Value:

A. The price of uranium delivered in connection with contract renegotiations or other than arm's length transactions.
B. The price of uranium delivered in connection with contracts which call for "market price" mechanisms. This exclusion applies particularly to contracts in which delivery prices are expressed as a function of Exchange Value or any other independent variable. Also excluded from consideration are all data where the delivery price is defined in such a way that it cannot currently be determined.

---

[2] Transaction Values for 1976 through 1981 and their associated parameters (millions of pounds, number of transactions and number of months) are tabulated on pages 31 and 32 of Report 161. Corresponding data for 1982 are tabulated on page 5 of Report 173.

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*CURRENT MARKET DATA*

**CONVERSION VALUE[1] $1.20/lb. U as $UF_6$**
Determined as of June 30, 1983

**Definition**

The Conversion Value is Nuexco's judgment of the price at which spot and/or near-term transactions for significant quantities of conversion services could be concluded in the secondary market as of the last day of the month.

**Derivation**

Nuexco bases the Conversion Value upon:

A. Data from recently completed transactions.
B. Data from pending transactions.
C. Firm bids to buy and firm offers to sell.
D. Prices purchasers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy, and prices sellers have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell.

**Comments**

Nuexco does not consider the following in determining the Conversion Value:

A. The price of conversion services delivered or to be delivered under old contracts.
B. The price of conversion services delivered in connection with contract renegotiations or other than arm's length transactions.

[1] Monthly data for 1981 and 1982 are tabulated on page 6 of Report 173.

**LOAN USE CHARGE RATE[2] 6%**
Determined as of June 30, 1983

**Definition**

The Loan Use Charge Rate is Nuexco's judgment of the annual interest rate at which uranium loans could be concluded as of the last day of the month.

**Derivation**

Nuexco bases the Loan Use Charge Rate upon:

A. Data from recently completed or pending loan transactions.
B. Rates included in firm proposals to borrow or lend.
C. Rates that potential borrowers and lenders have expressed as a willingness to pay or accept, but for which Nuexco is not aware of firm proposals.

[2] Monthly data for 1968 through 1981 appear on pages 32-34 of Report 162. Monthly data for 1982 appear on page 2 of Report 173.

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**SWU VALUE $103/SWU for FY84**
Determined as of June 30, 1983

### Definition

The SWU (Separative Work Unit) Value is Nuexco's judgment of the price, expressed in US dollars per SWU, at which transactions for the sale of significant quantities of SWU of any origin for delivery in the specified DOE fiscal year could be concluded as of the last day of the month.

### Derivation

Nuexco bases the SWU Value upon:

A. Data from recently completed transactions.
B. Data from pending transactions.
C. Firm bids to buy and firm offers to sell.
D. Prices purchasers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy, and prices sellers have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell.
E. SWU prices at varying tails assays and varying product assays are converted to the equivalent SWU price at the DOE Reference Transaction Tails Assay (presently 0.20 weight percent $U_{235}$) and a product assay of three percent $U_{235}$ assuming feed costs calculated using the Nuexco Exchange Value and Nuexco Conversion Value determined as of the last day of the same month.

### Comments

Nuexco does not consider the following in determining the SWU Value:

A. The price of SWU delivered under long-term contracts from primary suppliers, such as DOE, Urenco, or Eurodif.
B. The price of SWU delivered under other than arm's length transactions.

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*HISTORICAL MARKET DATA*

## EXCHANGE VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

| Country (currency) | per lb. $U_3O_8$ in Concentrates | per kg $U_3O_8$ in Concentrates | per kg U in Concentrates |
|---|---|---|---|
| Australia (dollar) | 26.83 | 59.16 | 69.76 |
| Belgium (comm. franc) | 1,194 | 2,633 | 3,104 |
| Canada (dollar) | 28.86 | 63.62 | 75.02 |
| Finland (markka) | 130.34 | 287.35 | 338.85 |
| France (franc) | 179.54 | 395.82 | 466.76 |
| FRG (mark) | 59.81 | 131.86 | 155.50 |
| Italy (lira) | 35,445 | 78,143 | 92,149 |
| Japan (yen) | 5,635 | 12,424 | 14,651 |
| Netherlands (guilder) | 67.05 | 147.81 | 174.31 |
| South Africa (rand) | 25.67 | 56.59 | 66.73 |
| Spain (peseta) | 3,406 | 7,508 | 8,854 |
| Sweden (krona) | 179.66 | 396.09 | 467.09 |
| Switzerland (franc) | 49.45 | 109.02 | 128.57 |
| UK (pound) | 15.38 | 33.92 | 40.00 |
| US (dollar) | 23.50 | 51.81 | 61.09 |

## TRANSACTION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

| Country (currency) | per lb. $U_3O_8$ in Concentrates | per kg $U_3O_8$ in Concentrates | per kg U in Concentrates |
|---|---|---|---|
| Australia (dollar) | 25.63 | 56.51 | 66.64 |
| Belgium (comm. franc) | 1,141 | 2,515 | 2,966 |
| Canada (dollar) | 27.57 | 60.77 | 71.67 |
| Finland (markka) | 124.51 | 274.51 | 323.71 |
| France (franc) | 171.52 | 378.13 | 445.91 |
| FRG (mark) | 57.14 | 125.97 | 148.55 |
| Italy (lira) | 33,861 | 74,651 | 88,032 |
| Japan (yen) | 5,384 | 11,869 | 13,996 |
| Netherlands (guilder) | 64.05 | 141.21 | 166.52 |
| South Africa (rand) | 24.52 | 54.06 | 63.75 |
| Spain (peseta) | 3,254 | 7,173 | 8,459 |
| Sweden (krona) | 171.64 | 378.39 | 446.22 |
| Switzerland (franc) | 47.24 | 104.15 | 122.82 |
| UK (pound) | 14.70 | 32.40 | 38.21 |
| US (dollar) | 22.45 | 49.49 | 58.37 |

[1] Calculated using currency exchange rates published in the Wall Street Journal on June 30, 1983.

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## CONVERSION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

| Country (currency) | per lb. U as $UF_6$ | per kg U as $UF_6$ |
|---|---|---|
| Australia (dollar) | 1.37 | 3.02 |
| Belgium (comm. franc) | 60.98 | 134.43 |
| Canada (dollar) | 1.47 | 3.25 |
| Finland (markka) | 6.66 | 14.67 |
| France (franc) | 9.17 | 20.21 |
| FRG (mark) | 3.05 | 6.73 |
| Italy (lira) | 1,810 | 3,990 |
| Japan (yen) | 287.77 | 634.42 |
| Netherlands (guilder) | 3.42 | 7.55 |
| South Africa (rand) | 1.31 | 2.89 |
| Spain (peseta) | 173.91 | 383.41 |
| Sweden (krona) | 9.17 | 20.23 |
| Switzerland (franc) | 2.53 | 5.57 |
| UK (pound) | 0.79 | 1.73 |
| US (dollar) | 1.20 | 2.65 |

## SWU VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

| Country (currency) | FY 1984 per SWU |
|---|---|
| Australia (dollar) | 117.61 |
| Belgium (comm. franc) | 5,234 |
| Canada (dollar) | 126.47 |
| Finland (markka) | 571.27 |
| France (franc) | 786.92 |
| FRG (mark) | 262.15 |
| Italy (lira) | 55,354 |
| Japan (yen) | 24,700 |
| Netherlands (guilder) | 293.87 |
| South Africa (rand) | 112.51 |
| Spain (peseta) | 14,928 |
| Sweden (krona) | 787.46 |
| Switzerland (franc) | 216.75 |
| UK (pound) | 67.43 |
| US (dollar) | 103.00 |

[1] Calculated using currency exchange rates published in the Wall Street Journal on June 30, 1983.

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*CURRENT MARKET DATA*

## TRANSACTION SUMMARY[1]

### Uranium Transactions

| Nuexco Transaction Number | Delivery Period | Approximate Quantity (thousands of pounds, $U_3O_8$ equivalent) | Approximate Price as Percent of Current E.V. | Seller | Buyer | Remarks |
|---|---|---|---|---|---|---|
| 2350 | 1983-85 | 1001-3000 | 95 | European Entity | European Utility | $UF_6$ |
| 2384 | 1984 | 101-300 | Approx. 99 | European Entity | European Utility | Enriched $UF_6$ |
| 2396 | 1983 | 51-100 | 100 | US Producer | US Producer | |
| 2399 | 1984 | 101-300 | indeterminate | US Producer | European Utility | Price related to market |

**Conversion Transactions** none reported

**Loan Transactions** none reported

## RECENT SWU TRANSACTIONS[1]

| Nuexco Transaction Number | Delivery Period[2] | Approximate Quantity (thousands of SWUs) | Approximate Price[3] as Percent of Current SWU Value | Tails Assay (Percent $U_{235}$) | Buyer Group | Seller Group | SWU Origin | Remarks |
|---|---|---|---|---|---|---|---|---|
| 2350B | 3Q85 | 50-100 | 115 | 0.3 | Europe | Europe | Eurodif | |
| 2359 | 1Q84 | less than 50 | 109 | 0.2 | US | Europe | Eurodif | |
| 2397 | 1985 | 25-50 | indeterminate | 0.3 | US | US | DOE | Barter |

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[1] Transactions listed are not limited to those in which Nuexco was involved, but also include others of which Nuexco is aware.

[2] Q refers to quarter of calendar year, *not* fiscal year.

[3] Price is *not* normalized to 0.20% tails assay.

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*CURRENT MARKET DATA*

## URANIUM SUPPLY
## (As of 6/30/83)

| Nuexco Project Number | Delivery Period[1] (Thousands of Pounds $U_3O_8$) | | Remarks |
|---|---|---|---|
| | Spot or Near-term[2] | Intermediate or Long-term[3] | |
| **Available for Sale:** | | | |
| **ACTIVE** | | | |
| 1575 | | 500 per year | Long Term |
| 1818 | | 250 per year | Long Term |
| 2017 | | 2,300 | |
| 2038 | 2,000 | | $UF_6$ |
| 2134 | | 300 per year | 1984 on |
| 2162 | 100 | | Primarily $UF_6$ |
| 2191 | 125 | | $UF_6$ |
| 2193 | | 800 per year | 1986-90 |
| 2201 | 30 | | |
| 2203 | 1,200 | | |
| 2219 | 200 | | Enriched $UF_6$ |
| 2220 | 150 | | $UF_6$ |
| 2235 | | 100 per year | 1985-87 |
| 2236 | | 200 per year | 1985-89 |
| 2246 | 40 | 100 | |
| 2275 | 80 | | |
| 2277 | 200 | | $U_3O_8$ or $UF_6$ |
| 2297 | 60 | 200 per year | 1985-89 |
| 2299 | 130 | | $UF_6$ |
| 2307 | 900 | | $UF_6$ |
| 2315 | 450 | | $UF_6$ |
| 2320 | 350 | | $UF_6$ |
| TOTAL: | 6,015 | | |
| **INACTIVE** | | | |
| 1877 | 40 | | |
| 2196 | 500 | | |
| 2271 | | 500 per year | 1984-88 |
| TOTAL: | 540 | | |

[1] Measured from the date of this Report

[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

[3] For delivery beyond one year.

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*CURRENT MARKET DATA*

## URANIUM DEMAND
## (As of 6/30/83)

| Nuexco Project Number | Delivery Period[1] (Thousands of Pounds $U_3O_8$) |  | Remarks |
|---|---|---|---|
|  | Spot or Near-term[2] | Intermediate or Long-term[3] |  |
| **Inquiries to Purchase:** |  |  |  |
| **ACTIVE** |  |  |  |
| 1871 |  | 250 per year | 1984-86 |
| 1996 | 400 |  |  |
| 2010 |  | 400 per year | 1984-92 |
| 2061 | 15 |  |  |
| 2071 | 70 |  | $UF_6$ |
| 2114 |  | 75 per year | 1984 on |
| 2115 |  | 200 per year | 1986 on |
| 2167 | 250 | 250+ per year | 1984-99 |
| 2187 | 50 |  |  |
| 2188 |  | 250 per year | 1985 on |
| 2214 | 400 |  | $UF_6$ |
| 2233 | 700 |  | 1984, $U_3O_8$ or $UF_6$ |
| 2240 | 100 |  |  |
| 2244 |  | 350 per year | 1985 on |
| 2277 | 50 |  | $U_3O_8$ or $UF_6$ |
| 2278 | 250 |  | $U_3O_8$ or $UF_6$ |
| 2304 |  | 500 per year | 1988 on |
| TOTAL: | 2,285 |  |  |
| **INACTIVE** |  |  |  |
| 1459 |  | 200 per year | Long Term |
| 1888 |  | 400 per year | Long Term |
| 1999 |  | 50 per year | 1985-90 |
| 2025 |  | 350 |  |

---

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

[3] For delivery beyond one year.

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## CONVERSION SUPPLY
### (As of 6/30/83)

| Nuexco Project Number | Delivery Period[1] (Thousands of Pounds U as UF$_6$) | | Remarks |
|---|---|---|---|
| | Within 3 Years | Beyond 3 Years | |
| **ACTIVE** | | | |
| 1609 | 1,500 | | |
| 1840 | 130 | | |
| 1936 | 1,500 | 200 per year | Long Term |
| 2051 | 1,500 | | |
| 2141 | 1,500 | | |
| 2143 | 400 | | |
| 2220 | 400 | | |
| 2222 | 100 | 175 | |
| TOTAL: | 7,030 | | |
| **INACTIVE** | | | |
| 2008 | 800 | 800 | |
| 2181 | 650 | 650 per year | Long Term |
| 2230 | 300 | | |
| TOTAL: | 1,750 | | |

## CONVERSION DEMAND
### (As of 6/30/83)

| Nuexco Project Number | Delivery Period[1] (Thousands of Pounds U as UF$_6$) | | Remarks |
|---|---|---|---|
| | Within 3 Years | Beyond 3 Years | |
| **ACTIVE** | | | |
| 2129 | 900 | | |
| 2135 | 400 | 135 per year | 1986-87 |
| 2199 | 450 | 300 per year | 1986 on |
| TOTAL: | 1,750 | | |
| **INACTIVE** | | | |
| 2190 | 400 | 200 per year | 1986 on |
| 2194 | | 300 per year | 1986 on |
| 2295 | 250 | | |
| TOTAL: | 650 | | |

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[1] Measured from the date of this Report.

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## LOAN SUPPLY AND DEMAND
(As of 6/30/83)

| Nuexco Project Number | Delivery Period[1] (Thousands of Pounds $U_3O_8$) | | Remarks |
|---|---|---|---|
| | Within 1 Year | Beyond 1 Year | |
| **Available for Loan:** | | | |
| **ACTIVE** | | | |
| 1938 | 1,500 | | $UF_6$ |
| 2121 | 600 | | |
| 2128 | 2,500 | | |
| 2205 | 300 | | |
| TOTAL: | 4,900 | | |
| **INACTIVE** | | | |
| 1815 | 1,000 | | $UF_6$ |
| 1884 | 600 | | |
| 2036 | 500 | | $UF_6$ |
| 2139 | 2,000 | | |
| TOTAL: | 4,100 | | |
| **Inquiries to Borrow:** | | | |
| **ACTIVE** | | | |
| 1998 | 200 | 200 | |
| 2006 | 600 | | |
| 2118 | 250 | | $U_3O_8$ or $UF_6$ |
| TOTAL: | 1,050 | | |
| **INACTIVE** | None | | |

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[1] Measured from the date of this Report

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## AUSTRALIA

Some factions of the Australian Labor Party (ALP) resented the Prime Minister's pronouncements, during his recent world tour, of foreign policy decisions seemingly contrary to the ALP platform. Their reaction forced him to announce the suspension of uranium shipments to France until nuclear testing in the Pacific is discontinued. Opposition to nuclear weapons testing is strong in Australia, so the move should be popular at first. However, the use of uranium trade restrictions as a political weapon will make it much more difficult for uranium producers to persuade potential buyers to regard Australia as a reliable supplier. Meanwhile France has initiated diplomatic consultations, an act that could help Mr. Hawke to ease the tension inside the ALP.

* * *

The South Australian state government (ALP) has recently approved the environmental impact statement for the development of the copper-uranium-gold project at Olympic Dam (Roxby Downs). Immediately upon the receipt of approval the project partners, Western Mining Corp. and BP Australia initiated the construction of an 18 million dollar pilot plant to test the treatment options for the complex multi-metal ore. The pilot plant will take approximately six months to build and will have a project life of approximately six months. The partners estimate that the feasibility study will take an additional six to eight months.

Underground development is underway; the developers expect to achieve 1.5 KM of tunnelling in ore this year. The earliest possible starting date for production is 1988, but that date is quite tentative, pending the results of the feasibility study.

## EUROPE

**Italy**, in the midst of a ten-year hiatus between start-ups of new nuclear power plants, may have found a key to plant siting problems, but still lacks the sense of direction necessary to follow through on sound nuclear policy.

In January of this year, the Parliament passed a law granting direct financial incentives to towns and regions agreeing to accept the siting of two 1,000 MWe nuclear units. ENEL (Ente Nazionale per l'Energia Elettrica) currently has three operating nuclear units comprising about 1,300 MWe, generating almost two percent of Italy's electricity. The national energy plan established a goal of 21.5 percent electricity from nuclear power by 1992, but heretofore, siting problems have presented a major hurdle to increasing the percentage of nuclear power. The new incentives have already led to serious discussions regarding the siting of new nuclear power plants between the federal government and the regions of Lombardi, Piedmont and Apuglia. Six other areas are awaiting the results of preliminary siting studies in hopes of participating in the financial benefits.

It would be premature to conlcude that Italy's nuclear power program is preparing for a great leap forward. The recent election of Italy's 44th parliament since World War II may have negated the progress made so far this year. Historically, because they involve relatively long lead times and large capital expenditures, nuclear power programs flourish under centralized, secure governments. It appears that the future of nuclear power in Italy will continue to be hampered by political instability and the double-digit inflation which can dramatically alter the economics of long-term capital-intensive projects. It is doubtful that any long-term economic reforms will be forthcoming from the new coalition. The losses suffered by the Christian Democrats, while not directly detrimental to the nuclear power program in Italy, may weaken the economic foundations of a program which was beginning to look promising again.

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*RECENT DEVELOPMENTS*

## UNITED STATES

Early this month, the Nuclear Regulatory Commission (NRC) announced that Florida Power and Light will receive a full operating license for its St. Lucie Unit 2, scheduled to begin operations later this summer. At the same time, the Senate Appropriations Subcommittee recommended against providing construction funds for the Clinch River Breeder Reactor during fiscal year 1984. The US Congress approved the project in 1972, however, as the estimated cost of the project has decreased, the possibility for construction is becoming remote.

* * *

As noted last month in the discussion of the Indian Point Units 2 and 3 emergency planning deficiencies, the NRC has assured Consolidated Edison that the units will not be shut down in the immediate future for lack of an emergency plan. The NRC decision, based on a 3-2 vote in favor of continued operation, was apparently influenced strongly by a Federal Emergency Management Agency (FEMA) report which concluded that progress toward an acceptable emergency plan was being made. The NRC is awaiting the findings of its special licensing board studying the safety of the station. The board is scheduled to forward its recommendations to the NRC in late August. It is unlikely that any further action will be forthcoming in the next 2-4 months.

* * *

Legislation to amend the Price-Anderson Act of 1957 has been introduced into Congress. The original Act has been extended twice and is now scheduled to expire in 1987. The proposed legislation, if successful, would remove the current ceiling on liability for nuclear plant operation. The authors of the bill suggest that the removal of the ceiling would encourage nuclear power plant safety by holding their operators fully responsible for their actions. In the event the Act is modified, or the ceiling is removed, it is likely that private insurance will be made available in sufficient amounts to compensate for foreseeable events.

* * *

The financial problems of the Washington Public Power Supply System (WPPSS) continue to hinder the construction of its nuclear projects. WPPSS once planned to build 5 nuclear units at an estimated cost of $4.1 billion. (See Report No. 162, page 13.) That estimate has risen to $23 billion, nearly six times the original projections.

At present, Unit 1 is 63 percent complete and construction was halted in April 1982; Unit 2 is 96 percent complete and fuel loading is scheduled for September 1983. The cost to complete the unit is estimated at $150 million. Unit 3 is 74 percent complete and will need an estimated $950 million in additional capital expenditures. Mothballing of this unit is estimated to cost between $300 to $700 million. The Executive Board has voted to halt all construction on Unit 3 for the next three years. Units 1, 2 and 3 are now backed through financial agreements with the Bonneville Power Administration (BPA), a federal energy distribution agency. This backing by the BPA means that Units 1, 2 and 3 still have a reasonable chance for commercial operation, in spite of the low power demand currently in the Northwest.

Units 4 and 5 were cancelled after nearly $2.25 billion in tax-exempt bonds were issued. The 88 northwestern utilities participating in Units 4 and 5 are now involved in a court dispute, as in June the interest payments associated with those bonds were missed. Such action could signal still more controversies in the future of these two units, with the prospect of bankruptcy certainly more serious than before. At least $70 to 100 million in negotiable assets are held by Units 4 and 5. One must wonder what effect a sudden sell-off of those assets would have on the fuel market.

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# US REACTOR CANCELLATIONS, PAST AND FUTURE

### Introduction

From time to time, Nuexco has reported cancellations of individual reactor plant orders and the past two year end reviews have summarized some of them (Report 161 of January 1982 and Report 173 of January 1983). This article presents a list of all the nuclear reactor orders canceled by US utilities since 1972, summarizes a DOE report analyzing the reasons for those cancellations, and finally, examines the potential for future cancellations.

### Summary of Cancellations

The first commercial order for a nuclear steam supply system (NSSS) in the USA was placed in 1953. The first cancellations of nuclear units occurred in 1972. As of June 30, 1983, 101 of the 251 orders placed had been canceled. Furthermore, 65 of those cancellations have taken place since 1978, the last year that any US utility placed an order for a nuclear steam supply system (NSSS). Table 1 lists all US reactor orders canceled from 1972 through June 30, 1983.

### Reasons for Cancellations

A recent report issued by DOE's Energy Information Administration (EIA), *Nuclear Plant Cancellations: Causes, Costs and Consequences*, analyzes reasons for the projects' cancellations and identifies potential future cancellations. The report listed five major reasons for cancelling nuclear units as cited by the constructing utility or regulatory commission:

1. lower forecasted load growth;
2. financial constraints;
3. regulatory changes and uncertainty;
4. reversal of economic advantage;
5. denial of certification by the state government.

Most of the 101 cancellations involved two or more of those reasons. Approximately half mentioned lower forecasted load growth. There has been a continuous downward trend in long-term load growth projections since 1973. Many utilities have chosen to cancel rather than defer nuclear units, because the ultimate cost of the unit becomes increasingly uncertain as deferral periods lengthen.

The problem of financial constraints primarily applies to investor-owned utilities; publicly-owned utilities have more flexibility to raise rates to cover increased costs. Eighty-eight of the 101 canceled units were being built by investor-owned utilities; five units were said to have been canceled solely because financing was not available on reasonable terms.

Regulatory changes and uncertainty was given as a primary reason for cancelling 38 nuclear units. In almost every case citing this reason, either financial constraints or reversal of economic advantage was also cited as a reason. Regulatory delays lengthen planning and lead times and changing design requirements involve construction changes; both lead to increased costs.

Five units were canceled solely because of reversal of economic advantage. Most utilities made their initial commitments to canceled nuclear units between 1967 and 1977. Nuclear capital costs have escalated faster than coal-fired plant costs since then, eroding nuclear power's advantage over coal. In 1982, another EIA study, *Projected Costs of Electricity from Nuclear and Coal-fired Power Plants*, concluded that "new nuclear plants entering service in 1995 would offer a significant cost advantage over coal-fired plants only in New England and the South Atlantic Regions." In its conclusion, the EIA report stated: "Because the completion of many of these plants could result in the displacement of electricity generated by oil and natural gas, thereby reducing the Nation's oil imports, this situation may not serve the best interest of electricity consumers or the Nation at large."

### Potential Future Cancellations

In Report 161 of January 1982, Nuexco's review of nuclear power developments in the USA in 1981 contained the following discussion of reactor cancellations:

> *The underlying problem with the US uranium market, insufficient consumption, was aggravated in 1981. Only three full power operating licenses were granted during the year. During the same period, six reactors were canceled and twenty-one others were delayed . . . .*
>
> *The cancellation of Hope Creek Unit 2 was especially important because the plant was 18 percent complete . . . . Before Hope Creek 2, the only cancellation of a unit significantly greater than one percent complete had been that of North Anna 4 in 1980, when it was 13 percent complete.*
>
> *It is Nuexco's opinion that there will be additional utility decisions to cancel at least fourteen reactors due to financial and political considerations . . . . Reactors having a low percentage completion are, all other things being equal, more vulnerable to cancellations*

> *than others. However, the cancellations of North Anna 4 and Hope Creek 2 indicate that cancellations of units up to 20 percent complete are possible. It is Nuexco's opinion that the cancellations of units up to 40 percent complete are not out of the question. . . . 28 reactors under construction in the US fall into the high-risk category of less than 20 percent complete. Nuexco believes at least fourteen more cancellations will take place in the next few years; not necessarily all of those expected cancellations are in the high-risk category.*

Accompanying that discussion of nuclear power developments in 1991 was a tabulation of US nuclear reactors then under construction, in which they were arranged in descending order of completion percentage *at the time*. The discussion called attention to the 44 units that were less than 40 percent complete as of June 30, 1981. Since that time, 36 of those 44 units have suffered cancellation or indefinite deferral or are presently considered "at risk" by the EIA. Only eight have come through the period relatively unscathed. Table 2 in this Report lists, in the same order in which they appeared in Report 161, those 44 reactors that were less than 40 percent complete as of June 30, 1981. Table 2 also indicates which reactors have since been canceled, indefinitely deferred, or designated as "at risk" by the EIA.

During the past eighteen months, 16 of the 28 units in the so-called "high-risk" category of less than 20 percent complete have been canceled. Eleven of the remaining 12 units in that category are considered "at risk" by the EIA, because they still are less than 20 percent complete. Only one unit of the 28, Georgia Power Company's Vogtle Unit 1, has maintained relatively high prospects for completion.

In that article in Report 161, Nuexco also mentioned that cancellations of units 20 to 40 percent complete were not out of the question. In the past eighteen months, two of the 16 units in that lesser-risk category have been cancelled (Tennessee Valley Authority's Phipps Bend Unit 1 and Washington Public Power Supply System's WNP Unit 4). Three more in that category have been indefinitely deferred; according to the EIA study, those three and three more are "at risk." Thus, at least nine of the 16 units in that category have suffered major setbacks of some kind, such that they have been canceled or become quite vulnerable to cancellation.

The EIA study identified a Base Case and Worst Case list of nuclear units currently under construction which are at risk. The thirteen Base Case units are those less than 20 percent complete at the end of 1981. The five Worst Case units are considered at risk for political and other reasons.

The Base Case units represent 14,726 MWe capacity and annual uranium consumption of approximately 4.8 million pounds $U_3O_8$, equivalent for reloads. The Worst Case units total 6,056 MWe capacity and annual uranium reload consumption of 2 million pounds. Thus, these two groupings of units vulnerable to cancellation represent uranium consumption of nearly 7 million pounds equivalent $U_3O_8$ per year.

**Conclusion**

Having taken in to consideration the likelihood of several more US reactor cancellations, Nuexco's forecasts would be little affected if the 18 units considered "at risk" by the EIA were canceled. However, the cost to the US utility industry and, ultimately, to the US electricity consumers could reach into the billions of dollars.

The near future of commercial nuclear power in the USA includes further nuclear plant cancellations and no new plant orders. The worst may be over, but the outlook is far from encouraging.

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## Table 1
## NUCLEAR REACTOR CANCELLATIONS BY U.S. UTILITIES SINCE 1972

| Year of Cancellation | Nuclear Unit | Net Design MWe | Utility[1] |
|---|---|---|---|
| 1972 | Bell Station | 838 | New York State Electric and Gas |
| | Crystal River 4 | 897 | Florida Power Corporation |
| | Malibu | 462 | Los Angeles Department of Water and Power |
| | Verplank 1 | 1,115 | Consolidated Edison |
| | Verplank 2 | 1,115 | Consolidated Edison |
| | Perryman 1 | 845 | Baltimore Gas and Electric |
| | Perryman 2 | 845 | Baltimore Gas and Electric |
| 1973 | None | — | — |
| 1974 | Tyrone 2 | 1,150 | Northern States Power |
| | Vidal 1 | 770 | Southern California Edison |
| | Vidal 2 | 770 | Southern California Edison |
| | Vogtle 3 | 1,113 | Georgia Power |
| | Vogtle 4 | 1,113 | Georgia Power |
| | Quanicassee 1 | 1,150 | Consumers Power |
| | Quanicassee 2 | 1,150 | Consumers Power |
| 1975 | Fulton 1 | 1,160 | Philadelphia Electric |
| | Fulton 2 | 1,160 | Philadelphia Electric |
| | Fermi 3 | 1,171 | Detroit Edison |
| | St. Rosalie 1 | 1,160 | Louisiana Power and Light |
| | St. Rosalie 2 | 1,160 | Louisiana Power and Light |
| | Barton 3 | 1,159 | Alabama Power |
| | Barton 4 | 1,159 | Alabama Power |
| | Summit 1 | 770 | Delmarva Power and Light |
| | Summit 2 | 770 | Delmarva Power and Light |
| | Orange 1 | 1,300 | Florida Power Corporation |
| | Orange 2 | 1,300 | Florida Power Corporation |
| | Somerset 1 | 1,200 | New York State Electric and Gas |
| | Somerset 2 | 1,200 | New York State Electric and Gas |
| 1976 | Allens Creek 2 | 1,150 | Houston Lighting and Power |
| 1977 | Douglas Point 1 | 1,146 | Potomac Electric Power |
| | Douglas Point 2 | 1,146 | Potomac Electric Power |
| | Sears Isle | 1,150 | Central Maine Power |
| | South Dade 1 | 1,100 | Florida Power and Light |
| | South Dade 2 | 1,100 | Florida Power and Light |
| | Surry 3 | 859 | Virginia Electric Power |
| | Surry 4 | 859 | Virginia Electric Power |
| | Ft. Calhoun 2 | 1,136 | Omaha Public Power District |
| | Barton 1 | 1,159 | Alabama Power |
| | Barton 2 | 1,159 | Alabama Power |

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[1] In cases where there is more than one owner, the constructing utility is listed.

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| Year of Cancellation | Nuclear Unit | Net Design MWe | Utility[1] |
|---|---|---|---|
| 1978 | North Coast 1 | 583 | Puerto Rico Water Resources Authority |
| | Sundesert 1 | 974 | San Diego Gas and Electric |
| | Sundesert 2 | 974 | San Diego Gas and Electric |
| | Blue Hills 1 | 918 | Gulf States Utilities |
| | Blue Hills 2 | 918 | Gulf States Utilities |
| | Zimmer 2 | 1,170 | Cincinnati Gas and Electric |
| | Atlantic 1 | 1,150 | Public Service Electric and Gas |
| | Atlantic 2 | 1,150 | Public Service Electric and Gas |
| | Atlantic 3 | 1,150 | Public Service Electric and Gas |
| | Atlantic 4 | 1,150 | Public Service Electric and Gas |
| | Haven 2 | 900 | Wisconsin Electric Power |
| | South River 1 | 1,150 | Carolina Power and Light |
| | South River 2 | 1,150 | Carolina Power and Light |
| | South River 3 | 1,150 | Carolina Power and Light |
| 1979 | Greene County | 1,212 | Power Authority State of New York |
| | Tyrone 1 | 1,100 | Northern States Power |
| | Palo Verde 4 | 1,270 | Arizona Public Service |
| | Palo Verde 5 | 1,270 | Arizona Public Service |
| | NEP 1 | 1,150 | New England Power and Light |
| | NEP 2 | 1,150 | New England Power and Light |
| | Stanislaus 1 | 1,200 | Pacific Gas and Electric |
| | Stanislaus 2 | 1,200 | Pacific Gas and Electric |
| 1980 | Davis-Besse 2 | 906 | Toledo Edison |
| | Davis-Besse 3 | 906 | Toledo Edison |
| | Erie 1 | 1,267 | Toledo Edison |
| | Erie 2 | 1,267 | Toledo Edison |
| | Jamesport 1 | 1,150 | Long Island Lighting |
| | Jamesport 2 | 1,150 | Long Island Lighting |
| | New Haven 1 | 1,250 | New York State Electric and Gas |
| | New Haven 2 | 1,250 | New York State Electric and Gas |
| | Sterling | 1,150 | Rochester Gas and Electric |
| | Haven 1 | 900 | Wisconsin Electric Power |
| | Greenwood 2 | 1,264 | Detroit Edison |
| | Greenwood 3 | 1,264 | Detroit Edison |
| | Forked River 1 | 1,070 | Jersey Central Power and Light |
| | North Anna 4 | 907 | Virginia Electric Power |
| | Montague 1 | 1,150 | Northeast Utilities |
| | Montague 2 | 1,150 | Northeast Utilities |

[1] In cases where there is more than one owner, the constructing utility is listed.

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| Year of Cancellation | Nuclear Unit | Net Design MWe | Utility[1] |
|---|---|---|---|
| 1981 | Bailly | 644 | Northern Indiana Public Service |
| | Pilgrim 2 | 1,150 | Boston Edison |
| | Callaway 2 | 1,120 | Union Electric |
| | Harris 3 | 900 | Carolina Power and Light |
| | Harris 4 | 900 | Carolina Power and Light |
| | Hope Creek 2 | 1,067 | Public Service Electric and Gas |
| 1982 | WNP 4 | 1,218 | Washington Public Power Supply System |
| | WNP 5 | 1,240 | Washington Public Power Supply System |
| | Black Fox 1 | 1,150 | Public Service of Oklahoma |
| | Black Fox 2 | 1,150 | Public Service of Oklahoma |
| | Perkins 1 | 1,280 | Duke Power |
| | Perkins 2 | 1,280 | Duke Power |
| | Perkins 3 | 1,280 | Duke Power |
| | Vandalia | 1,270 | Iowa Power and Light |
| | Pebble Springs 1 | 1,260 | Portland General |
| | Pebble Springs 2 | 1,260 | Portland General |
| | Hartsville B1 | 1,233 | Tennessee Valley Authority |
| | Hartsville B2 | 1,233 | Tennessee Valley Authority |
| | Phipps Bend 1 | 1,233 | Tennessee Valley Authority |
| | Phipps Bend 2 | 1,233 | Tennessee Valley Authority |
| | Allens Creek 1 | 1,150 | Houston Lighting and Power |
| | Cherokee 2 | 1,280 | Duke Power |
| | Cherokee 3 | 1,280 | Duke Power |
| | North Anna 3 | 907 | Virginia Electric Power |
| 1983 | Cherokee 1 | 1,280 | Duke Power |

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[1] In cases where there is more than one owner, the constructing utility is listed.

## Table 2

### US NUCLEAR POWER REACTORS UNDER CONSTRUCTION (WHICH WERE LESS THAN 40 PERCENT COMPLETE AS OF 6/30/81)[1]

| Reactor | Utility | Percent Complete[1] | Estimated COD[1] | Status |
|---|---|---|---|---|
| Nine Mile Point 2 | Niagara Mohawk Power Corp. | 38 | 10/86 | |
| Millstone 3 | Northeast Utilities | 36 | 5/86 | |
| Hope Creek 1 | Public Service Electric & Gas (PSEG) | 35 | 12/86 | |
| **Hartsville A1 | Tennessee Valley Authority (TVA) | 34 | 7/88[2] | Indefinitely deferred. Now "at risk". |
| Catawba 2 | Duke Power Co. | 32 | 9/85 | |
| River Bend 1 | Gulf States Utilities Co. | 31 | 4/84 | |
| WNP 3 | Washington Public Power Supply System (WPPSS) | 30.6 | 12/86 | |
| **Limerick 2 | Philadelphia Electric Co. | 27.5 | 10/87 | Currently "at risk". |
| Phipps Bend 1 | TVA | 27 | 2/89[3] | Cancelled. |
| **Hartsville A2 | TVA | 26 | 4/89[2] | Indefinitely deferred. Now "at risk". |
| **Yellow Creek 1 | TVA | 26 | 4/88[2] | Indefinitely deferred. Now "at risk". |
| Marble Hill 1 | Public Service of Indiana | 25 | late 86 | |
| WNP 4 | WPPSS | 24.2 | 6/87[3] | Cancelled. |
| *South Texas Project 2 | Houston Lighting & Power | 23 | —/86 | "At risk". |
| **Grand Gulf 2 | Mississippi Power & Light | 22.4 | 9/86 | "At risk". |
| Palo Verde 3 | Arizona Nuclear Power Project (ANPP) | 21 | 5/86 | |
| Vogtle 1 | Georgia Power Co. | 18 | 5/85 | |
| Hartsville B1 | TVA | 17 | Indef[3] | Cancelled. |
| WNP 5 | WPPSS | 13.7 | 12/87[3] | Cancelled. |
| *Marble Hill 2 | Public Service of Indiana | 11 | late 87 | "At risk". |
| *Vogtle 2 | Georgia Power Co. | 10 | 11/86 | "At risk". |
| North Anna 3 | Virginia Electric & Power Co. | 08.8 | —/89[3] | Cancelled. |
| *Seabrook 2 | Public Service Co. of New Hampshire | 08 | 5/86 | "At risk". |
| Hartsville B2 | TVA | 07 | Indef[3] | Cancelled. |
| Phipps Bend 2 | TVA | 05 | Indef[3] | Cancelled. |
| *Shearon Harris 2 | Carolina Power & Light Co. | 03 | 3/88 | "At risk". |
| *Yellow Creek 2 | TVA | 03 | Indef[2] | Indefinitely deferred. Now "at risk". |
| Black Fox 1 | Public Service Co. of Oklahoma | 0-1wa[5] | 7/91[3] | Cancelled. |
| Black Fox 2 | Public Service Co. of Oklahoma | 0-1wa[5] | 7/94[3] | Cancelled. |
| *Clinton 2 | Illinois Power Co. | 0-cp[6] | Indef | "At risk". |
| Allens Creek | Houston Light & Power | 0 | —/91[3] | Cancelled. |
| *Carroll County 1 | Commonwealth Edison Co. | 0 | Indef | "At risk". |
| *Carroll County 2 | Commonwealth Edison Co. | 0 | Indef | "At risk". |

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| | | | | |
|---|---|---|---|---|
| *Cherokee 1 | Duke Power Co. | 0 | Indef[4] | Cancelled. |
| Cherokee 2 | Duke Power Co. | 0 | Indef[3] | Cancelled. |
| Cherokee 3 | Duke Power Co. | 0 | Indef[3] | Cancelled. |
| Pebble Springs 1 | Portland General Electric Co. | 0 | 9/88[3] | Cancelled. |
| Pebble Springs 2 | Portland General Electric Co. | 0 | 9/90[3] | Cancelled. |
| Perkins 1 | Duke Power Co. | 0 | Indef[3] | Cancelled. |
| Perkins 2 | Duke Power Co. | 0 | Indef[3] | Cancelled. |
| Perkins 3 | Duke Power Co. | 0 | Indef[3] | Cancelled. |
| *River Bend 2 | Gulf States Utilities Co. | 0 | Indef | "At risk". |
| *Skagit-Hanford 1 | Puget Sound Power & Light | 0 | —/91 | "At risk". |
| *Skagit-Hanford 2 | Puget Sound Power & Light | 0 | —/93 | "At risk". |

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*Considered "at risk by DOE's Energy Information Administration because reactor was less than 20 percent complete as of 12/31/81.

**Considered "at risk" by EIA for political and other reasons.

[1] Nuclear News World List of Nuclear Power Plants

[2] Indefinitely deferred in 1982

[3] Cancelled in 1982

[4] Cancelled in 1983

[5] Limited work authorization

[6] Construction permit

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*FOCUS*

## URANIUM DEMAND AND SUPPLY IN JAPAN

### Introduction

Japan has one of the world's most active nuclear programs. However, it has suffered the same types of delays that have affected those of other countries. Thus, its objectives have been reduced considerably during the past decade. From the optimistic projections prevalent prior to the 1973-74 energy crisis, Japan has, in several stages, reduced its targets for the nuclear generation of electricity and related services to more realistic levels. Although *official* government estimates are still somewhat optimistic, one can predict with reasonable accuracy Japan's needs for uranium over the next decade. This article presents an analysis of Japan's balance of uranium supply demand, based on the present status of nuclear plant licensing and of economic, environmental, and technological factors. In addition, this article projects the probable future activity of the Japanese utilities in the international market for uranium and related services.

### Overview

During its 25-year history, Japan's national program for nuclear power generation has been based primarily on the light water reactor (LWR). In the early 1970s, government and utility planning called for installed nuclear capacity in excess of 60,000 MWe by 1985. Subsequently, the nuclear industry has had to face the same realities encountered by other industrial nations implementing nuclear programs. Japan has also had to grapple with problems related to siting, environment, economic growth, non-proliferation safeguards, safety and technology, and perhaps more than other nations, a public intensely sensitive to nuclear power. By the late 1970s, Japan had essentially halved its objective for 1985 installed nuclear capacity, revising the target to 30,000 MWe. The presence of only minor uranium deposits dictated that Japanese utilities base their uranium procurement policies entirely on imports from overseas. Primarily due to the optimistic forecasts of the early and mid-1970s, Japanese utilities entered into a series of large, long-term contracts to satisfy the major portion of their uranium needs through the 1980s. Emphasizing geographical diversity, Japanese utilities established relationships with a number of overseas suppliers. Additionally, the nuclear industry made commitments to actively pursue the exploration, development, and production of uranium in overseas uranium projects, either by direct participation or by providing financing in exchange for sharing in the output of such projects.

Japan's dependence on imports has not been limited to the supply of uranium. To a large degree, LWR technology was introduced from overseas via licensing arrangements. Readily assimilated by Japan's major companies, that technology today forms the foundation for a self-sufficient domestic industry for the supply of hardware and systems for nuclear generating facilities. However, for the initial and current supply of conversion, enrichment and reprocessing services, Japan has found it necessary to rely on long-term contract commitments from Europe and the USA. Japan has a defined program to develop self-sufficiency throughout the fuel cycle in which technology demonstration projects have been completed. However, commercial-scale production facilities are not scheduled for completion until the late 1980s or early 1990s.

Japan also has completed projects to demonstrate the technology for an Advanced Thermal Reactor (ATR) and a Fast Breeder Reactor (FBR). Plans are being implemented to construct larger plants of the same types. Objectives are to permit the use of slightly enriched uranium, mixed oxide fuels and plutonium to reduce future uranium needs. Similarly, the testing of mixed oxide fuels in LWRs is being initiated for the same purpose. Plans call for these programs to become commercially useful in the 1990s.

### Nuclear Power Generation

Japan's current installed capacity for nuclear generation of electricity (as shown in Table 3) consists of 24 units having a total capacity of 17,177 MWe. The total does not include the 165 MWe ATR demonstration plant. Figure 1 shows the geographical distribution of Japan's installed nuclear power plants.

Although accounting for only 13 percent of Japan's total 1982 installed generating capacity of 135,000 MWe, nuclear plants actually generated 20.5 percent of Japan's total electricity consumption of more than 102 million MWH. Official 1982 Japanese government estimates of generating costs are summarized in Table 6. Even with recent reductions in the price of oil and increased construction costs of nuclear plants, nuclear generation of electricity is expected to play a continuing and expanding role in Japan's energy needs. The Japan Atomic Industrial Forum reports that Japan's 12 Boiling Water

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Reactors (BWR) and 11 Pressurized Water Reactors (PWR) also established in 1982 a new record of 67.7 percent capacity factor, and 68.2 percent availability. Without the annual shutdowns mandated for inspections and maintenance, unique to Japan, those percentages could have reached as much as 95 percent. In May, 1983 Tokyo Electric Power Company's (TEPCO) Fukushima II-1 plant established a new LWR record of 400 days in continuous operation.

Overall economic planning by the Japanese government in April 1983 projects that nuclear generation will account for 30 percent of Japan's electricity with an installed capacity of approximately 46,000 MWe in 1992. However, as noted in Report 175 of March 1983, Japanese utilities announced a prediction of "realistic" capacity of 37,350 MWe by 1991. The utility estimate tends to be supported by reference to Table 4. Listed are current Japan LWR plants by categories of "Under Construction", "In Licensing", and "Submitted to EPRDCC" (Electric Power Resources Development Coordination Council). EPRDCC is a governmental council which reviews the utility-proposed plant location and capacity for conformance to overall national economic planning and the need for additional generating capacity. The same EPRDCC review also includes a preliminary environmental review and public hearing at the location of the proposed plant. Only after EPRDCC approval is a proposed plant considered an actual project and eligible for safety and license approval review.

Reference to Table 4 indicates an additional firm total of approximately 21,357 MWe capacity which is planned to be operational by 1991. Assuming completion as scheduled, that total combined with the 17,177 MWe currently operating would equal 38,534 MWe by 1992. That total could go as high as 46,000 MWe by 1992 if, as shown in Table 5, several of the plants planned by utilities but not yet submitted to the EPRDCC could be completed on schedule. Several factors, however, tend to compromise the possibility of achieving the higher 1992 goal. First, licensing schedules historically have been subject to delay. Second, reduced load growth due to current economic conditions may lessen the need for the additional capacity, or at least retard it beyond the indicated schedule. Within the first four months of 1983, Japan's utilities announced delays of 3-12 months for 6 of the 18 plants currently under construction or licensing. As in other parts of the world, reduced need for the additional capacity prompted their actions. Furthermore, as energy conservation measures and slower economic growth have led to reduced power sales, utilities have begun to experience lower profits and the resulting cash flow problems.

### Japan's Uranium Balance

Based on nuclear generation forecasts of the 1970s, Japan's utilities purchased large quantities of uranium, primarily via long-term contracts, some of which extend beyond 1995. Nuexco estimates that those commitments totaled approximately 400 million pounds $U_3O_8$, equivalent. Based on deliveries to date, approximately half of the total remains to be delivered over the next 10-12 years. The great majority of the material originates from suppliers in Canada, Australia and South Africa. Japanese utilities are also part owners of the Overseas Uranium Resources Development Company (OURD), which is a participant in the Akouta project in Niger. The utilities will receive more than two million pounds of $U_3O_8$ per year via OURD. In addition, Japan Australia Uranium Resources Development Company (JAURD) has invested in production by Energy Resources of Australia (ERA). Several Japanese utilities are part owners of JAURD and will receive approximately two million pounds $U_3O_8$ per year from Ranger production. Over the next ten years, those two arrangements account for approximately 20 percent of Japan's future delivery commitments from overseas suppliers.

Some rough approximations can lend perspective to the current supply-demand situation. Were Japan to achieve the government goal of 46,000 MWe installed capacity by 1992, annual uranium consumption would rise to approximately 15 million pounds $U_3O_8$. Nuexco's forecast of uranium consumption indicates an approximate annual average 10-12 million pounds $U_3O_8$ for the next ten years. Considering the current inventory of at least 35-45 million pounds $U_3O_8$ equivalent, in the form of $U_3O_8$ or natural $UF_6$, plus the 200 million pounds of $U_3O_8$ contracted for future delivery, it is apparent that Japan's utilities are covered well in excess of realistic needs. Furthermore, including enriched $UF_6$ inventory of 40-60 million pounds $U_3O_8$ equivalent would raise the current total to 75-105 million pounds. Other forms, such as $UO_2$, bring the total out-of-core inventory to 100-140 million pounds $U_3O_8$, equivalent.

Assuming a stable political and economic situation in the world, and specifically in the countries of Japan's principal uranium suppliers, one can conclude that Japan utilities have achieved secure, stable supply of uranium at least until the mid-1990s. Use of the recently announced "realistic" total capacity estimate of the utilities results in an even more conservative conclusion. Factors which could influence such simplified conclusions are:

1. The foregoing analysis refers to the nine private Japanese utilities, plus Japan Atomic Power Company (JAPC), collectively. JAPC is a separate entity, principally owned by the nine utilities, established to pioneer the design, construction and operation of first-of-a-kind reactors or new generations of existing designs. Of those ten companies, several of the medium-sized and smaller utilities could have unfilled uranium needs before the mid-1990s. Although they could probably make arrangements with other utilities to cover any short falls, it is possible that they might choose to contract for some additional supplies instead.

2. Underachieving the targeted goal for installed nuclear capacity would mean a positive balance of supply even beyond the mid-1990s. Conversely, if over the next few years progress on planned new projects matches the government's schedules, Japanese utilities may choose to make some additional purchases. However, delays are much more likely.

3. Reliance on overseas supply engenders even more caution in the already conservative policies of Japanese utilities. Indications of problems, such as those of political issues, labor disputes, or the formation of a cartel, threatening supply from one of Japan's principal uranium suppliers, could have a major impact on how the utilities view their current positive balance.

4. Japan has yet to commit to a definite policy for the stockpiling of uranium within Japan for protection against emergencies. The current natural uranium inventory of 35-45 million pounds $U_3O_8$ owned by individual utilities is not physically located within Japan, but is held in overseas locations. For several years, the topic of a national stockpile located in Japan has been discussed. Generally, a figure of two years' requirements in the form of $U_3O_8$ or enriched uranium has been mentioned. Such a stockpile could readily be achieved from Japan's already committed long-term supplies, but the definition of such a strategic stockpile policy is probably still some years away.

5. Recently there have been indications that the utilities might consider their inventory positions large enough to sell some of their surplus uranium. Aside from the psychological barrier associated with the sale of any resources, major obstacles are price and the need for government approvals. Under present long-term contracts, Japanese utilities renegotiate prices annually for deliveries one or two years in the future. Prices for 1983 and 1984 deliveries from major suppliers were recently established in the range of $33-36 per pound $U_3O_8$. Although these prices represent significant reductions from the previous several years, they are still considerably above possible selling prices in the current world market. It is very doubtful that Japanese utilities would consider selling at prices below those they are paying. Some pressure to sell also has recently surfaced in the national legislature; opposition parties have criticized the current administration's policy of permitting the utilities to hold such large inventories. To date those criticisms have been negated by arguments in favor of the need to assure security of resources. Any sales of inventories would reduce the supply surplus, but it is highly unlikely that the amounts would be large in comparison to the total inventory.

6. An alternative to the outright sale of uranium by the utilities has also received attention. Some suggestions have been made that perhaps Japanese utilities might lend material to overseas entities with commitments for return at a future date. This would appear to be a more likely possibility. The utilities have some domestic experience, having lent material to one another on occasion. An obstacle to any major overseas loan would be the providing of suitable guarantees for return of the material by the borrower, who would almost certainly have to be a major utility or a governmental agency. Any loans would alter the timing, but not the amount, of the cumulative supply surplus.

7. To date there have been no indications that Japanese utilities plan to seek any substantial renegotiations of their current long-term contracts with overseas suppliers to relieve any apparent excess of commitments. Their desire to maintain relations with established, reliable suppliers is an overriding concern compared to the possible advantages of change in the shorter term. In the course of several years, as the next decade's electricity generation plans become firmer, the possibility of some nominal renegotiation might increase. Nevertheless, it is reasonably certain that Japan's utilities will continue to value highly the stability of relationships.

8. Approximately twenty Japanese organizations are also participating in uranium exploration in various areas of the world. Most of those companies were organized by Japanese industrial and financial groups during the 1970s when optimism prevailed on targeted nuclear power generation and the world market uranium price was

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rising. Subsequently, after a number of token or unsuccessful efforts, most of those companies are intact. Historically, the most active Japanese organization has been the Power Reactor and Nuclear Fuel Development Corporation (PNC). PNC is a semi-government organization with primary funding from the Japanese government. PNC has maintained active exploration projects in Africa, Canada, Australia and the USA. Discoveries have been announced in Western Australia, British Columbia, and Mali. International Resources Corp., whose owners include Japan's three largest utilities, has located significant reserves in Niger. North American Resources, representing Mitsubishi interests in Japan, is exploring with Getty Oil in the USA. Idemitsu, a major Japanese oil company, has active joint venture exploration programs in Australia and Canada.

Development of reserves discovered to date, or likely to be discovered as a result of the above exploration, has been, or probably will be, delayed based on the current world uranium market. The economic development of some is not likely to materialize until beyond the mid-1990s and, consequently, will not significantly alter Japan's current indicated balance of supply.

### Other Reactor Concepts

Japan is actively pursuing other reactor concepts as alternatives to its basic reliance on LWRs. Those alternatives are aimed at the use of slightly enriched uranium, mixed oxide fuels, and plutonium, thereby mitigating Japan's reliance on imported uranium.

Since 1977, PNC has operated a 50 MWth experimental Fast Breeder Reactor (FBR), subsequently upgraded to 75 MWth. Having demonstrated the basic FBR technology, PNC upgraded the reactor to 100 MWth in March 1983 and converted it for use as an irradiation reactor. A follow-up 300 MWe FBR for power generation has long been part of Japan's program. After many delays, that plant has passed initial safety reviews, and is now scheduled for 1994 completion.

A 165 MWe Advanced Thermal Reactor (ATR), also has been operated by PNC since 1979, with the objective of demonstrating its capability to serve as an alternative to Japan's standard LWRs. The ATR is a heavy-water-moderated, light-water-cooled reactor fueled with slightly enriched uranium, mixed oxide fuel, or both. Although the private utility sector raised a number of questions as to the need for such a reactor, a decision was reached in early 1983 to proceed with a 600 MWe ATR, essentially as a national project. Using PNC technology it is to be built for operation by 1994 by the Electric Power Development Corporation (EPDC). EPDC is a semi-government company, similar to TVA (the Tennessee Valley Authority) in the USA, which to date has developed a significant share of Japan's hydroelectric capacity.

In March, 1983 PNC also completed the world's first plutonium conversion facility. With a capacity of 10 Kg per day, such a plant will fabricate developmental mixed oxide (MOX) fuel for use in Japan's LWR and ATR. Plans are to supply demonstration fuel to representative BWR and PWR plants in Japan by the late 1980s. The same plans call for commercial use of MOX fuel in Japan's LWR plants by 1995.

The aforementioned reactor concepts and planning cannot be expected to effect any signficant reduction of future uranium requirements until early in the next centutury. Through the 1990s, Japan will still be reliant upon its LWR programs for nuclear generation, and on overseas uranium to supply them.

### Enrichment and Reprocessing

From the beginning of Japan's LWR program for nuclear power generation, the nine private utilities and JAPC have relied almost exclusively upon the USDOE for enrichment services. In recent years, they have made some nominal commitments. to Eurodif. Collectively, the nine utilities and JAPC have contracted for more than an adequate quantity of enrichment services through 1987-1988. Enrichment needs beyond that time are not yet fully covered.

Although Japan's overall balance of enrichment services is more than adequate, the individual utilities' balances vary considerably. Several utilities have been actively exploiting the opportunities available in the secondary SWU market. During the past several years, Japanese utilities have accepted assignments of approximately 2 million SWU, covering needs in the 1983-1987 period.

The Japanese government, for some years via PNC, has had an active national program to develop a domestic capability to provide enrichment services. The program is based on developing Japan's own centrifuge technology. To date the program has achieved technical success. PNC initiated operation of a 70 to SWU per year pilot plant in March, 1982 which currently is functioning as predicted. However, the program has encountered delays in establishing a commercial-scale enrichment facility. One of the

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major problems appears to be the lack of the customary cooperation between the Japanese government and private industry to achieve a common goal.

The government is proposing that private industry accept the obligation to furnish enrichment services by application of PNC technology. The private sector appears cooperative but without the usual sense of urgency found in energy matters. The utilities also attach no particular urgency to the problem of enrichment services supply. Adequate and reliable supply from the USA and Europe, including that of the secondary SWU market, would appear to put Japanese buyers in a secure position for an indefinite time.

In a recent display of semi-displeasure, the government agencies publicly urged the utilities to form a new company to design, build and operate a 1500 ton SWU per year facility no later than 1989. Concurrently, the government urged the three LWR manufacturers (Toshiba, Hitachi and Mitsubishi Heavy Industries) to form a joint company capable of manufacturing the estimated 100,000 machines needed to build such a facility and expand it to 3000 ton SWU per year by the year 2000. Such an expanded facility would be able to supply approximately one-third of Japan's future enrichment needs. The government has also expressed frustration with delays in proceeding with PNC plans to build an enrichment demonstration plant of 200 tons SWU annual capacity. In an unusual circumstance, three communities are lobbying for the placement of such a facility in their areas. This contrasts to previous experiences, in which local governments have vigorously opposed other nuclear facilities. The proposed PNC demonstration plant would reach 100 tons SWU capacity by 1986 and full capacity by 1987.

Japan also is involved in several programs for the development of alternate enrichment technology. The government and utilities have participated in the UEGA (Uranium Enrichmen Group of Australia) evaluation aimed at the supply of Australia's uranium in the form of enriched material. Should the Australian program materialize, Japanese interests would probably encounter substantial pressure to make a significant financial investment to maintain relations with one of the countries representing a major source of their needed uranium. This would be in addition to enrichment services already contracted from the USA and Europe, as well as the domestic program which will almost certainly proceed. Another enrichment technology is being investigated in the private sector by Asahi Chemical Industries (ACI). With some government funding, ACI has successfully enriched uranium on a pilot plant scale using ion exchange technology. Currently, ACI is installing a larger size facility for further demonstration tests. Details available on development work are minimal, but public announcements to date have been optimistic. Success in commercialization by ACI would mean that the ion exchange technology would be competing for development funds against centrifuge technology.

Japan's national program for a high degree of self-sufficiency in the nuclear fuel cycle includes the capability for domestic reprocessing of nuclear fuel. After considerable delay PNC started operation of a 0.7 ton per day demonstration plant in 1977. Basic technology was introduced from France. Although successful in verifying process viability, the plant has been plagued by considerable hardware corrosion problems. Although the facility has successfully reprocessed several batches of limited quantities of domestic utilities' spent LWR fuel, problems with dissolver equipment forced it to shut down in February 1983. The plant will probably be out of operation for two years and, when it does restart, its capacity might be derated.

In 1979, Japan's basic nuclear laws were changed to permit private industry to operate reprocessing facilities, until then restricted to government operation. Subsequently Japan Nuclear Fuel Services (JNFS) a private sector company, was established with principal ownership by the utilities and a number of other nuclear industry particpants. Initial plans called for three plants of 5 short tons uranium per day capacity to be made operational sequentially within the 1990s. Those plans have been revised substantially. Currently, JNFS is planning a single 1000 ton per year facility scheduled for operation in the early 1990s. In the interim, the utilities are faced with an ever increasing quantity of spent fuel from their LWR program.

To date the Japanese utilities have contracted for significant quantities of reprocessing by England and France. However, LWR spent fuel is accumulating in excess of those contracts. The excess is being accumulated at plant sites by means of re-racking of fuel storage pools for higher density storage. Planning of the new JNFS facility includes accelerating construction of the receiving and storage portion of the plant to provide additional interim storage.

Presently, Japanese utilities' planning for reprocessing faces the highest degree of uncertainty in Japan's effort to achieve adequate coverage of the entire fuel cycle. Still unresolved is the ultimate storage of high level wastes, the

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return of which they are obligated to accept after overseas reprocessing, as well as those from the planned JNFS plant. Such uncertainties in turn leave open to question the ultimate value of planned advance reactors such as the ATR and FBR, and the expected reduction of future uranium requirements.

## Summary

1. In Report 175 of March 1983, Nuexco forecast 33,570 MWe of installed nuclear generating capacity in Japan by March 1991. Since then two additional plants have received their construction licenses, and one has received EPRDCC approval to apply for its license. However, recently it was announced that the commercial operation dates for all three would be delayed six months. One plant already under construction was also delayed six months in the interim. Those changes are reflected in Table 4.

If all plants were completed on the schedules indicated in Table 4, the total would be 21,357 MWe. Added to the current 17177 MWe in operation, the result would be an approximate total of 38,500 MWe capacity by the end of 1991. That total corresponds with announcements by the Japanese utilities. However, Nuexco forecasts call for further delays during the construction and licensing of these plants, resulting in a total capacity of approximately 33,500 MWe in operation by 1991.

2. Nuexco's 1991 forecast of 33,500 MWe equates to annual consumption of approximately 10-12 million pounds $U_3O_8$ from 1983 to 1991. That level of consumption is 20-33 percent less than the approximately 15 million pounds per year required to meet a goal of 46,000 MWe by 1992. That conclusion lends further support to the statement that, collectively, Japan's utilities are adequately supplied into the mid-1990s.

3. In the current market there appears to be little or no incentive for the Japanese utilities to commit to additional quantities of uranium by extension of current contracts or by the execution of new, long-term contracts. Any procurement activity for the next several years will potentially be limited to:

a. Nominal purchases to compensate for unforeseen interruptions of deliveries from current long-term suppliers;

b. Some additional intermediate-term purchases by several utilities with a somewhat less positive inventory balance than the group average;

c. Purchases for a national stockpile, should such a concept materialize. However, Nuexco feels any decision is several years away and that the group's requirements can be filled from current long-term contracts of individual utilities.

4. Conversely, it now appears the utilities can more realistically forecast plant additions and uranium needs for the next ten years. Assuming no events which could be interpreted as threatening stable supply, it is conceivable that some utilities with longer than average supply contracts may take action within several years to alleviate that situation. In order of descending probability, those are:

a. Loan of near-term deliveries for future repayment;

b. Transfer of deliveries to a national stockpile;

c. At least some renegotiation to reduce annual delivery commitments of current long-term contracts;

d. Sale of nominal amounts of uranium, in particular if prices recover significantly above current levels.

5. Some Japanese utilities will be active in further commitments for enrichment services. Nuexco forecasts call for the domestic enrichment plan to suffer further delays. In that event, the utilities will supply their needs for enrichment service between new overseas commitments, and continuing use of the secondary SWU market. The longer-term meaning of the USDOE's new Facilities Requirements (FR) type contracts still is not apparent to the utilities. Attractive prices offered by Eurodif recently perhaps favor additional commitment to Europe.

6. Japan's nuclear generation will be LWR-based, at least until the year 2000. The current alternate reactor concepts and reprocessing will not affect basic uranium needs until the post-2000 period.

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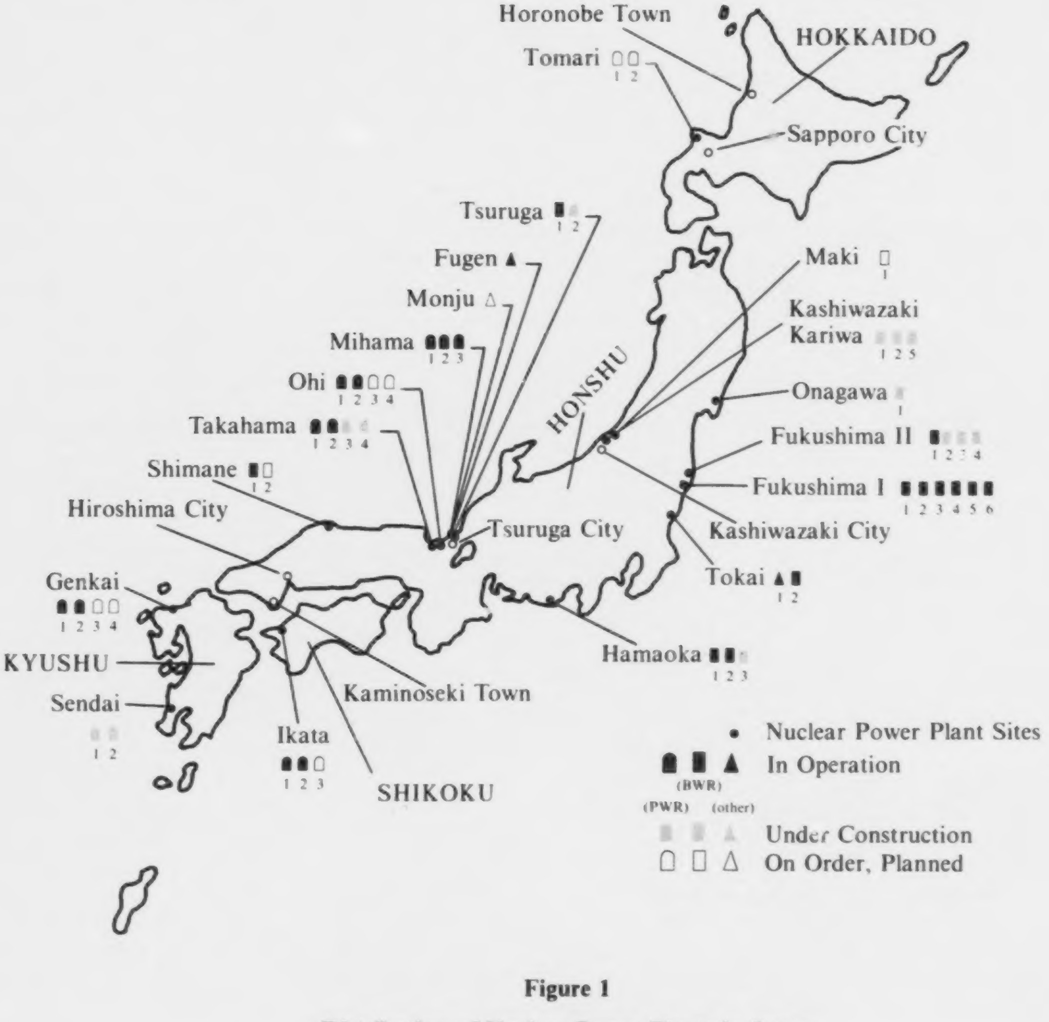
Horonobe Town
HOKKAIDO
Tomari
1 2
Sapporo City
Tsuruga
1 2
Fugen
Monju
Mihama
1 2 3
Ohi
1 2 3 4
Takahama
1 2 3 4
Shimane
1 2
Hiroshima City
Genkai
1 2 3 4
KYUSHU
Sendai
1 2
Ikata
1 2 3
SHIKOKU
Kaminoseki Town
Tsuruga City
HONSHU
Maki
1
Kashiwazaki
Kariwa
1 2 5
Onagawa
1
Fukushima II
1 2 3 4
Fukushima I
1 2 3 4 5 6
Kashiwazaki City
Tokai
1 2
Hamaoka
1 2 3
Nuclear Power Plant Sites
In Operation
(BWR)
(PWR)
(other)
Under Construction
On Order, Planned

**Figure 1**

**Distribution of Nuclear Power Plants in Japan**

(Does not include units planned, but not yet submitted to EPRDCC, listed in Tables)

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## Table 3

## OPERATING NUCLEAR POWER PLANTS IN JAPAN

| Power Plant | Utility | Reactor Type | Capacity (MWe) | Start of Operation |
|---|---|---|---|---|
| Tokai-1 | JAPC | GCR | 166 | Jul. '66 |
| Tokai-2 | JAPC | BWR | 1,100 | Nov. '78 |
| Tsuruga | JAPC | BWR | 357 | Mar. '70 |
| Fukushima I-1 | Tokyo E.P. Co. | BWR | 460 | Mar. '71 |
| Fukushima I-2 | Tokyo E.P. Co. | BWR | 784 | Jul. '74 |
| Fukushima I-3 | Tokyo E.P. Co. | BWR | 784 | Mar. '76 |
| Fukushima I-4 | Tokyo E.P. Co. | BWR | 784 | Oct. '78 |
| Fukushima I-5 | Tokyo E.P. Co. | BWR | 784 | Apr. '78 |
| Fukushima I-6 | Tokyo E.P. Co. | BWR | 1,100 | Oct. '79 |
| Fukushima II-1 | Tokyo E.P. Co. | BWR | 1,100 | Apr. '82 |
| Hamaoka-1 | Chubu E.P. Co. | BWR | 540 | Mar. '76 |
| Hamaoka-2 | Chubu E.P. Co. | BWR | 840 | Nov. '78 |
| Mihama-1 | Kansai E.P. Co. | PWR | 340 | Nov. '70 |
| Mihama-2 | Kansai E.P. Co. | PWR | 500 | Jul. '72 |
| Mihama-3 | Kansai E.P. Co. | PWR | 826 | Dec. '76 |
| Takahama-1 | Kansai E.P. Co. | PWR | 826 | Nov. '74 |
| Takahama-2 | Kansai E.P. Co. | PWR | 826 | Nov. '75 |
| Ohi-1 | Kansai E.P. Co. | PWR | 1,175 | Mar. '79 |
| Ohi-2 | Kansai E.P. Co. | PWR | 1,175 | Dec. '79 |
| Shimane-1 | Chugoku E.P. Co. | BWR | 460 | Mar. '74 |
| Ikata-1 | Shikoku E.P. Co. | PWR | 566 | Sept. '77 |
| Ikata-2 | Shikoku E.P. Co. | PWR | 566 | Mar. '82 |
| Genkai-1 | Kyushu E.P. Co. | PWR | 559 | Oct. '75 |
| Genkai-2 | Kyushu E.P. Co. | PWR | 559 | Mar. '81 |
| TOTAL | | | 17,177 | |

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### Table 4

### STATUS OF SCHEDULED NUCLEAR POWER PLANTS IN JAPAN

| Power Plant | Utility | Reactor Type | | Capacity (MWe) | Start of Operation |
|---|---|---|---|---|---|
| **Under Construction** | | | | | |
| Onagawa-1 | Tohoku E.P. Co. | BWR | | 524 | June 1984 |
| Fukushima II-2 | Tokyo E.P. Co. | BWR | | 1,100 | Jan. 1984 |
| Fukushima II-3 | Tokyo E.P. Co. | BWR | | 1,100 | July 1985 |
| Fukushima II-4 | Tokyo E.P. Co. | BWR | | 1,100 | Sept. 1987 |
| Kashiwazaki-1 | Tokyo E.P. Co. | BWR | | 1,100 | Oct. 1985 |
| Takahama-3 | Kansai E.P. Co. | PWR | | 870 | Aug. 1984 |
| Takahama-4 | Kansai E.P. Co. | PWR | | 870 | Feb. 1985 |
| Sendai-1 | Kyushu E.P. Co. | PWR | | 890 | July 1984 |
| Sendai-2 | Kyushu E.P. Co. | PWR | | 890 | March 1986 |
| Tsuruga-2 | JAPC | PWR | | 1,160 | June 1987 |
| Hamaoka-3 | Chubu E.P. Co. | BWR | | 1,100 | Sept. 1986 |
| Kashiwazaki-2 | Tokyo E.P. Co. | BWR | | 1,100 | Oct. 1989 |
| Kashiwazaki-5 | Tokyo E.P. Co. | BWR | | 1,100 | April 1990 |
| | | | Subtotal | 12,904 | |
| **Under Licensing (Approved by EPRDCC)** | | | | | |
| Kyowa Tomari-1 | Hokkaido E.P. Co. | PWR | | 579 | Dec. 1988 |
| Kyowa Tomari-2 | Hokkaido E.P. Co. | PWR | | 579 | Dec. 1990 |
| Shimane-2 | Chugoku E.P. Co. | BWR | | 820 | Sept. 1988 |
| Genkai-3 | Kyushu E.P. Co. | PWR | | 1,180 | Oct. 1990 |
| Ikata-3 | Shikoku E.P. Co. | PWR | | 890 | March 1990 |
| | | | Subtotal | 4,048 | |
| **Under EPRDCC Review** | | | | | |
| Ohi-3 | Kansai E.P. Co. | PWR | | 1,200 | June 1990 |
| Ohi-4 | Kansai E.P. Co. | PWR | | 1,200 | Feb. 1991 |
| Genkai-4 | Kyushu E.P. Co. | PWR | | 1,180 | Oct. 1991 |
| Maki | Tohoku E.P. Co. | BWR | | 825 | Dec. 1991 |
| | | | Subtotal | 4,405 | |
| | | | TOTAL ALL CATEGORIES | 21,357 | |

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### Table 5

### PLANNED NUCLEAR PLANTS IN JAPAN (NOT YET SUBMITTED TO EPRDCC)

| Power Plant | Utility | Reactor Type | Capacity (MWe) | Start of Operation |
|---|---|---|---|---|
| Higashi-Dori-1 | Tohoku E.P. Co. | BWR | 1,180 | March 1993 |
| Onagawa-2 | Tohoku E.P. Co. | BWR | 824 | Sept. 1992 |
| Namie-Odaka | Tohoku E.P. Co. | BWR | 824 | Sept. 1994 |
| Kashiwazaki-3 | Tokyo E.P. Co. | BWR | 1,100 | July 1992 |
| Kashiwazaki-4 | Tokyo E.P. Co. | BWR | 1,100 | July 1993 |
| N-1 | Chubu E.P. Co. | BWR | 1,100 | Sept. 1992 |
| Noto | Hokuriku E.P. Co. | BWR | 540 | March 1992 |
| Toyokita-1 | Chugoku E.P. Co. | BWR | 1,100 | Nov. 1993 |
| Toyokita-2 | Chugoku E.P. Co. | BWR | 1,100 | Nov. 1995 |
| | | TOTAL | 8,868 | |

### Table 6

### ESTIMATED UNIT COSTS OF ELECTRICITY GENERATION IN JAPAN

| Source | Cost Yen per KWH |
|---|---|
| nuclear | 12 |
| coal | 15 |
| LNG | 19 |
| Hydro | 20 |
| oil | 20 |

Source: Japan Agency of Natural Resources and Energy

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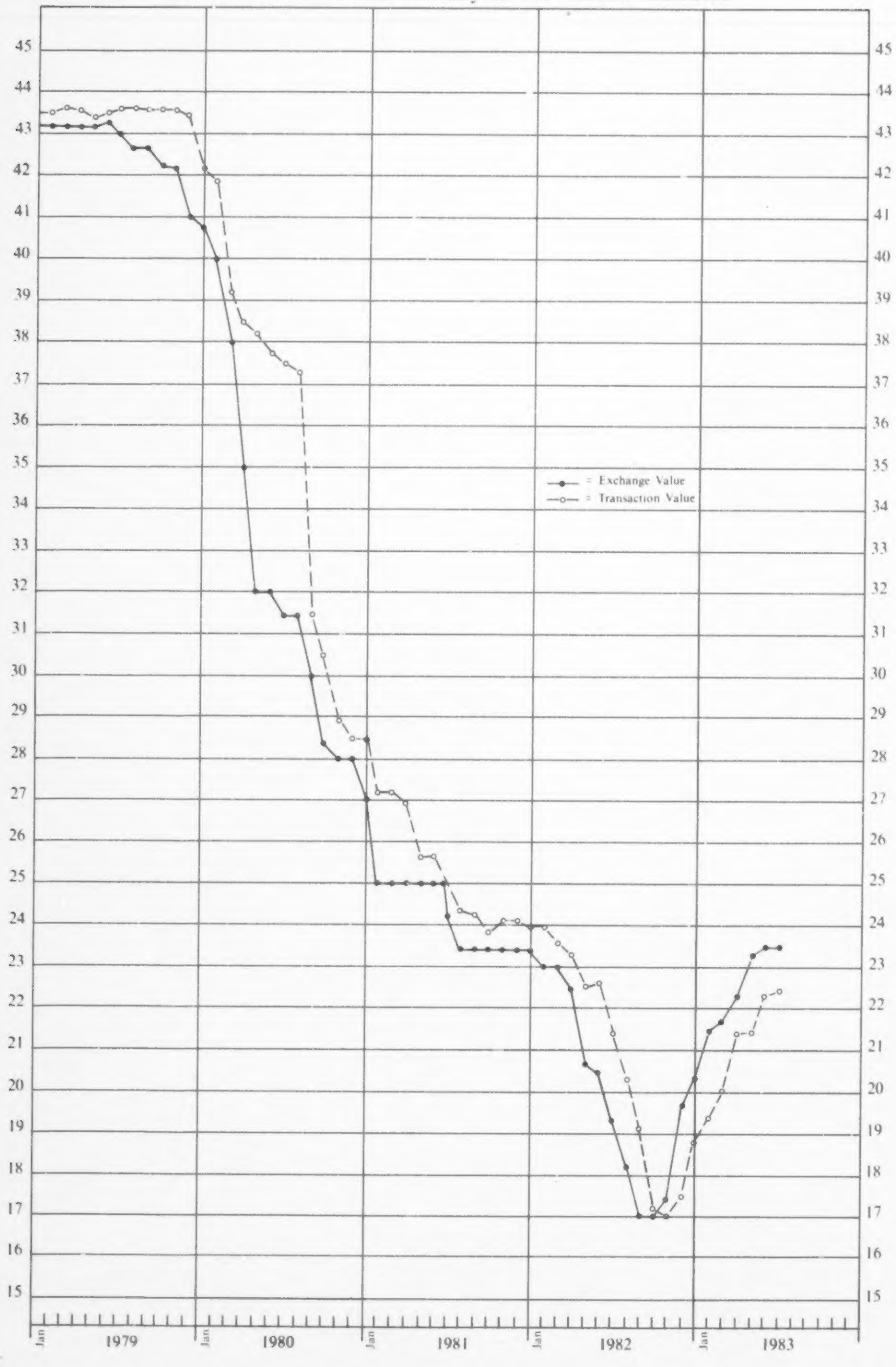
*HISTORICAL MARKET DATA*

### EXCHANGE AND TRANSACTION VALUES SINCE JANUARY 1979

Determined as of the last day of the month indicated



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## HISTORICAL EXCHANGE VALUES

Determined as of the last day of the month indicated (US Dollars/lb. $U_3O_8$)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1968 | — | — | — | — | — | — | — | 6.35 | 6.35 | 6.40 | 6.45 | 6.50 |
| 1969 | — | 6.35 | 6.10 | 6.10 | 6.25 | 6.25 | 6.20 | 6.20 | 6.15 | 6.15 | 6.15 | 6.20 |
| 1970 | 6.30 | 6.30 | 6.30 | 6.30 | 6.30 | 6.30 | 6.30 | 6.20 | 6.15 | 6.15 | 6.15 | 6.15 |
| 1971 | 6.20 | 6.20 | 6.20 | 6.20 | 6.15 | 6.05 | 6.00 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 |
| 1972 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 |
| 1973 | 5.95 | 6.00 | 6.10 | 6.20 | 6.45 | 6.50 | 6.50 | 6.50 | 6.50 | 6.50 | 6.75 | 7.00 |
| 1974 | 7.70 | 7.90 | 8.00 | 9.00 | 9.50 | 10.50 | 11.50 | 12.00 | 12.50 | 14.00 | 14.75 | 15.00 |
| 1975 | 16.00 | 16.00 | 18.00 | 20.00 | 21.00 | 23.00 | 24.70 | 26.00 | 26.00 | 28.50 | 30.00 | 35.00 |
| 1976 | 35.20 | 37.00 | 39.25 | 40.00 | 40.00 | 40.00 | 40.00 | 40.40 | 41.00 | 41.00 | 41.50 | 41.00 |
| 1977 | 41.35 | 41.50 | 41.60 | 41.60 | 42.00 | 42.25 | 42.25 | 42.25 | 42.40 | 42.75 | 43.20 | 43.20 |
| 1978 | 42.90 | 43.25 | 43.25 | 43.25 | 43.40 | 43.40 | 43.40 | 43.10 | 43.25 | 43.00 | 43.25 | 43.25 |
| 1979 | 43.25 | 43.25 | 43.25 | 43.25 | 43.25 | 43.00 | 42.70 | 42.70 | 42.20 | 42.20 | 41.00 | 40.75 |
| 1980 | 40.00 | 38.00 | 35.00 | 32.00 | 32.00 | 31.50 | 31.50 | 30.00 | 28.50 | 28.00 | 28.00 | 27.00 |
| 1981 | 25.00 | 25.00 | 25.00 | 25.00 | 25.00 | 24.25 | 23.50 | 23.50 | 23.50 | 23.50 | 23.50 | 23.50 |
| 1982 | 23.00 | 23.00 | 22.50 | 20.75 | 20.50 | 19.25 | 18.25 | 17.00 | 17.00 | 17.50 | 19.75 | 20.25 |
| 1983 | 21.50 | 21.75 | 22.25 | 23.25 | 23.50 | **23.50** | | | | | | |

## HISTORICAL TRANSACTION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. $U_3O_8$)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1976 | — | — | — | — | 39.60 | 39.70 | 39.70 | 40.40 | 40.30 | 40.60 | 40.70 | 40.70 |
| 1977 | 41.30 | 41.30 | 41.40 | 41.50 | 42.80 | 42.90 | 43.00 | 42.60 | 42.50 | 42.80 | 42.90 | 42.90 |
| 1978 | 43.10 | 43.30 | 43.70 | 43.60 | 43.60 | 43.20 | 43.30 | 43.40 | 43.40 | 43.60 | 43.40 | 43.70 |
| 1979 | 43.60 | 43.80 | 43.70 | 43.40 | 43.60 | 43.70 | 43.70 | 43.60 | 43.60 | 43.60 | 43.50 | 42.30 |
| 1980 | 42.00 | 39.30 | 38.60 | 38.40 | 37.90 | 37.60 | 37.30 | 31.60 | 30.60 | 29.00 | 28.70 | 27.70 |
| 1981 | 27.20 | 27.20 | 27.00 | 25.70 | 25.70 | 24.50 | 24.40 | 24.30 | 23.90 | 24.10 | 24.10 | 24.00 |
| 1982 | 24.00 | 23.70 | 23.40 | 22.60 | 22.70 | 21.50 | 20.30 | 19.10 | 17.30 | 17.00 | 17.55 | 18.80 |
| 1983 | 19.35 | 20.00 | 21.35 | 21.40 | 22.35 | **22.45** | | | | | | |

## HISTORICAL CONVERSION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. $U_6$)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1981 | 1.20 | 1.20 | 1.20 | 1.40 | 1.15 | 1.15 | 1.15 | 1.10 | 1.10 | 1.10 | 1.20 | 1.20 |
| 1982 | 1.20 | 1.20 | 1.20 | 1.20 | 1.00 | 1.00 | 1.00 | 0.90 | 1.10 | 1.60 | 1.45 | 1.45 |
| 1983 | 1.20 | 1.40 | 1.40 | 1.20 | 1.20 | **1.20** | | | | | | |

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*GOVERNMENT STATISTICS*

## AUSTRALIA

| | Price Index of Materials Used in Manufacturing Industry—All Groups (Year 1968-69 = 100.0)[1] | Award Rates of Pay Indexes Australia—Adult Males In Mining Wage Earners, Weekly Rates (Year 1976 = 100.0)[2] |
|---|---|---|
| Annual Avg. 1972[3] | 105.6 | 71.26 |
| Annual Avg. 1973[3] | 124.4 | 78.96 |
| Annual Avg. 1974[3] | 141.9 | 108.07 |
| Annual Avg. 1975[3] | 150.4 | 132.55 |
| Annual Avg. 1976[3] | 168.4 | 160.93 |
| Annual Avg. 1977[3] | 192.0 | 179.03 |
| Annual Avg. 1978[3] | 198.5 | 190.04 |
| Annual Avg. 1979 | 248.8 | 196.34 |
| Annual Avg. 1980 | 321.8 | 218.00 |
| Annual Avg. 1981 | 355.3 | 237.34 |
| Annual Avg. 1982 | 367.9 | — |
| Jan 1982 | 354.9 | 169.3[2] |
| Feb 1982 | 356.7 | 171.1[2] |
| Mar 1982 | 360.3 | 171.4[2] |
| Apr 1982 | 367.7 | 171.4[2] |
| May 1982 | 367.6 | 171.9[2] |
| Jun 1982 | 367.8R | 173.2[2] |
| Jul 1982 | 369.7R | 177.2[2] |
| Aug 1982 | 372.1R | 178.1[2] |
| Sep 1982 | 374.6R | 178.2[2] |
| Oct 1982 | 377.8R | 178.3[2] |
| Nov 1982 | 375.1R | 178.4[2] |
| Dec 1982 | 374.3R | 179.4[2] |
| Jan 1983 | 386.2R | 179.1[2] |
| Feb 1983 | 388.0R | 179.0[2] |
| Mar 1983 | 397.3P | 178.9[2] |

P = Preliminary  R = Revised since last month

[1] Australian Bureau of Statistics, Canberra: "Price Index of Materials Used in Manufacturing Industry" (Catalogue No. 6411.0), Table 3.

[2] Australian Bureau of Statistics, Canberra: "Award Rates of Pay Indexes, Australia" (Catalogue No. 6312.0), Table 8. Figures are being converted to an Index number. As the data are converted, the new index numbers will be inserted. Figures for the latest fourteen months shown are subject to revision.

[3] Monthly data for 1970 through 1978 appear on pages 4.7 and 4.8 of Nuexco Report 138.

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## CANADA

| | Industry Selling Price Index: Manufacturing (D 500000)[1] [2] (1971 = 100.0) | Wage-earner Data: Average Hourly Earnings (C$)[4] [5] | | |
|---|---|---|---|---|
| | | **Metal Mining, including Milling (SIC 050-099)[3]** | **Primary Metal Industries, non-ferrous (SIC 296-298)** | **Chemicals and Chemical Products (SIC 370-379)** |
| Annual Avg. 1979 | 217.9 | 9.66 | 7.35 | 7.67 |
| Annual Avg. 1980 | 247.2 | 10.80 | 8.05 | 8.50 |
| Annual Avg. 1981 | 288.8P | 12.23 | 9.03 | 9.53 |
| Mar 1982 | 284.8 | 13.74 | 9.62 | 10.35 |
| Apr 1982 | 287.7 | 13.81 | 9.79 | 10.48 |
| May 1982 | 288.8 | 13.86 | 9.88 | 10.62 |
| Jun 1982 | 289.7 | 13.83 | 9.92 | 10.69 |
| Jul 1982 | 290.3 | 14.02 | 10.05 | 10.73 |
| Aug 1982 | 290.3 | 14.23 | 10.03 | 10.80 |
| Sep 1982 | 292.4 | 14.01 | 10.18 | 10.73 |
| Oct 1982 | 292.1 | 13.89 | 10.18 | 10.86 |
| Nov 1982 | 291.3 | 14.28 | 10.43 | 10.90 |
| Dec 1982 | 292.3 | 14.32 | 10.55 | 11.06 |
| Jan 1983 | 292.7 | 14.35R | 10.72 | 11.06 |
| Feb 1983 | 293.5R | 14.31R | 10.79R | 11.07R |
| Mar 1983 | 295.2 | 14.65P | 10.95P | 11.21P |
| Apr 1983 | 297.0R | — | — | — |
| May 1983 | 298.5 | | | |

P = Preliminary R = Revised since last month

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[1] Statistics Canada, Prices Division, Ottawa: "Industry Price Indexes" (Catalogue 62-011), Table 1. Indexes for the most recent six months shown are subject to revision.

[2] Monthly data for 1973 through 1978 appear on page 4.10 of Nuexco Report 138.

[3] The wage earner series in Nuexco reports prior to March 1983 was Metals (SIC 050-059).

[4] Statistics Canada, Labour Division, Employment and Payrolls Section, Ottawa: "Employment, Earnings and Hours" (Catalogue 72-002), Table 2.

[5] Monthly data for 1977 and 1978 appear on page 4.11 of Nuexco Report 138.

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*GOVERNMENT STATISTICS*

## REPUBLIC OF SOUTH AFRICA

| | Average Declared Working Costs per Metric Ton of Gold Ore Milled (Rand)[1] | Consumer Price Index[2] (1975 = 100, except where otherwise indicated) | Producer[5] Price Index All Groups (1975 = 100) | Total Employment in Mining and Quarrying (Code 35)[7] | Total Salaries and Wages in Mining and Quarrying (1,000 Rand) (Code 40)[7] |
|---|---|---|---|---|---|
| Annual Avg. 1972[3] | 8.79 | 113.3[4] | 63.9 | 623,067 | 443,933 |
| Annual Avg. 1973[3] | 10.51 | 124.1[4] | 72.3 | 684,743 | 572,133 |
| Annual Avg. 1974[3] | 13.18 | 138.5[4] | 85.3 | 674,140 | 761,596 |
| Annual Avg. 1975[3] | 16.71 | 157.2[4] | 100.0 | 639,473 | 1,003,617 |
| Annual Avg. 1976[3] | 19.30 | 174.7[4] | 115.1 | 671,240 | 1,212,983 |
| Annual Avg. 1977[3 6] | 23.87 | 194.4[4] | 130.0 | 712,006 | 1,420,670 |
| Annual Avg. 1978[3 6] | 27.14 | 137.2 | 142.7 | 664,571 | 1,537,169 |
| Annual Avg. 1979[3 6] | 30.18 | 155.3 | 164.5 | 692,209 | 1,830,632 |
| Annual Avg. 1980[6] | 35.53 | 176.7 | 192.1 | 714,379 | 2,279,615 |
| Annual Avg. 1981 | 41.89 | 206.5 | 218.3 | 728,506 | 2,820,505 |
| Annual Avg. 1982 | 47.25 | 233.5 | 248.7 | 707,552 | 3,246,071 |
| Dec 1981 | 44.52 | 216.3 | 230.4 | 709,612 | 257,655 |
| Jan 1982 | — | 217.6 | 233.1 | 700,375 | 257,173 |
| Feb 1982 | — | 220.2 | 236.8 | 705,992 | 250,191 |
| Mar 1982 | 45.49 | 225.2 | 237.4 | 725,700 | 262,210 |
| Apr 1982 | — | 228.9 | 241.9 | 707,502 | 252,562 |
| May 1982 | — | 230.3 | 244.8 | 715,162 | 258,770 |
| Jun 1982 | 45.77 | 232.1 | 246.7 | 707,552 | 261,361 |
| Jul 1982 | — | 234.1 | 249.4 | 702,141 | 283,248 |
| Aug 1982 | — | 236.8 | 253.4 | 705,562 | 276,730 |
| Sep 1982 | 48.04 | 241.0 | 255.0 | 704,344 | 282,782 |
| Oct 1982 | — | 243.9 | 260.1 | 701,316 | 285,328 |
| Nov 1982 | — | 245.4 | 262.5 | 707,966 | 287,699 |
| Dec 1982 | 49.62 | 246.2 | 263.0 | 683,982 | 288,019 |
| Jan 1983 | — | 249.0 | 264.9 | 688,030 | 289,075 |
| Feb 1983 | — | 253.1 | 267.4 | 697,089 | 281,413 |
| Mar 1983 | 50.35 | 255.9 | 269.1 | 672,891 | 282,476 |
| Apr 1983 | — | 257.8 | 270.9 | — | — |
| May 1983 | — | 259.7 | — | — | — |

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[1] Chamber of Mines of South Africa, Johannesburg; "Analysis of Working Results," published quarterly. The tonnage-weight index of average working costs per metric ton of gold ore milled for 1983 is as follows. (Base: March quarter 1982 = 100). See Nuexco report #178 page 24 for the tonnage-weighted index for 1982. Description and calculation of the index is on page 16 of Nuexco report #178.

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[2] Republic of South Africa Department of Statistics, Pretoria; "Government Gazette: Consumer Price Index for Urban Areas."

[3] Historical data for the Average Declared Working Costs and Consumer Price Index 1970-1979 appear on page 4.9 of Nuexco Report 140.

[4] April 1970 = 100.00.

[5] Previously known as the WHOLESALE PRICE INDEX, now the PRODUCER PRICE INDEX. The computation remains the same.

[6] Historical data for Codes 35 and 40 1977-1980 appear on page 28 of Nuexco Report 157.

[7] Bulletin of Statistics, Department of Statistics, Pretoria.

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## UNITED STATES

| | Producer Price Index— Industrial Commodities (1967 = 100)[1] | Producer Price Index— All Commodities (1967 = 100)[1] | Consumer Price Index (1967 = 100)[2] | GNP Implicit Price Deflator (1972 = 100)[3] | Gross Average Hourly Earnings of Production or Non-supervisory Workers (US$)[4] | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Metal Mining (SIC 10) | Primary Non-ferrous Metals (SIC 333) | Chemicals and Allied Products (SIC 28) | Electric and Electronic Equipment (SIC 36) |
| Annual Avg. 1972[5] | 117.9 | 119.1 | 125.3 | 100.00 | 4.56 | 4.59 | 4.26 | 3.71 |
| Annual Avg. 1973[5] | 125.9 | 134.7 | 133.1 | 105.75 | 4.84 | 4.98 | 4.51 | 3.91 |
| Annual Avg. 1974[5] | 153.8 | 160.1 | 147.7 | 115.08 | 5.44 | 5.63 | 4.88 | 4.21 |
| Annual Avg. 1975[5] | 171.5 | 174.9 | 161.2 | 125.79 | 6.13 | 6.24 | 5.39 | 4.64 |
| Annual Avg. 1976[5] | 182.4 | 183.0 | 170.5 | 132.34 | 6.76 | 6.87 | 5.91 | 4.96 |
| Annual Avg. 1977[5] | 195.1 | 194.2 | 181.5 | 140.05 | 7.28 | 7.67 | 6.43 | 5.39 |
| Annual Avg. 1978[5] | 209.4 | 209.3 | 195.4 | 150.42 | 8.23 | 8.56 | 7.02 | 5.82 |
| Annual Avg. 1979[5] | 236.5 | 235.6 | 217.4 | 163.42 | 9.27 | 9.50 | 7.60 | 6.32 |
| Annual Avg. 1980[5] | 274.8 | 268.8 | 246.8 | 178.64 | 10.26 | 10.63 | 8.30 | 6.94 |
| Annual Avg. 1981 | 304.1 | 293.4 | 272.4 | 195.51 | 11.55 | 11.98 | 9.12 | 7.62 |
| Annual Avg. 1982 | 312.3 | 299.3 | 289.1 | 207.15 | 12.33R | 12.94R | 9.96R | 8.21R |
| May 1982 | 309.6 | 298.6 | 287.1 | — | 12.29R | 12.74R | 9.81R | 8.10R |
| Jun 1982 | 310.6 | 299.3 | 290.6 | 205.98 | 12.28R | 12.95R | 9.94R | 8.14R |
| Jul 1982 | 312.8 | 300.4 | 292.2 | — | 12.23 | 12.94R | 10.00R | 8.23R |
| Aug 1982 | 313.2 | 300.2 | 292.8 | — | 12.29 | 13.01R | 10.01R | 8.30R |
| Sep 1982 | 312.7 | 299.3 | 293.3 | 208.51 | 12.53 | 13.51R | 10.19R | 8.37R |
| Oct 1982 | 314.3 | 299.8 | 294.1 | — | 12.51R | 13.26R | 10.22R | 8.41R |
| Nov 1982 | 315.0 | 300.3 | 293.6 | — | 12.53R | 13.22R | 10.26R | 8.45R |
| Dec 1982 | 315.2 | 300.7 | 292.4 | 210.42 | 12.53R | 13.05R | 10.32R | 8.51R |
| Jan 1983 | 313.9R | 299.9R | 293.1 | — | 12.63R | 13.33R | 10.34R | 8.53R |
| Feb 1983 | 314.4P | 301.2P | 293.2 | — | 12.66R | 13.29R | 10.41R | 8.56R |
| Mar 1983 | 313.4P | 300.5P | 293.4 | 213.26 | 12.48R | 13.35R | 10.39R | 8.60R |
| Apr 1983 | 312.6P | 300.8P | 295.5 | — | 12.67 | 13.28 | 10.43R | 8.60R |
| May 1983 | 313.8P | 301.7P | 297.1 | — | — | — | 10.52P | 8.59P |

P = Preliminary R = Revised since last month

[1] US Bureau of Labor Statistics, Washington, D.C.: "Producer Prices and Price Indexes," Table 6 (formerly "Wholesale Prices and Price Indexes"). Producer Price Indexes are revised four months after they are first released to reflect the availability of late reports and corrections by respondents.

[2] US Bureau of Labor Statistics, Washington, D.C.: Consumer Price Index for All Urban Consumers, US City Average, All Items.

[3] US Department of Commerce, Washington, D.C.; Bureau of Economic Analysis, National Income and Wealth Division; "Survey of Current Business," Table A. The GNP Implicit Price Deflator is published quarterly, and seasonally adjusted.

[4] US Bureau of Labor Statistics, Washington, D.C.: "Employment and Earnings," Table C-2. All data based on 1972 revision of SIC Manual. Data for 1970-1976 are adjusted to the March 1977 benchmark. Data for 1977-1978 are adjusted to the March 1979 benchmark. Data for January 1979 and beyond are adjusted to the March 1980 benchmark.

[5] Monthly data 1970-1978 for Producer Price Index-Industrial Commodities, Consumer Price Index, and Employment and Earnings SIC codes 10, 333, and 28, and quarterly data for GNP Implicit Price Deflator appear on pages 4.6-4.8 of Nuexco Report 139.
Monthly data 1977-1978 for Employment and Earnings SIC Codes 10, 333, and 28 appear on page 33 of Nuexco Report 147.
Monthly data 1970-1978 for Employment and Earnings SIC Code 36 appear on page 23 of Nuexco Report 154.
Monthly data 1979-1980 for Employment and Earnings, Revised Establishment Data, all listed codes, appear on page 22 of Nuexco Report 158.
Monthly data 1977-1980 for Producer Price Index-All Commodities, appear on page 21 of Nuexco Report 158.

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# NUEXCO

AUGUST 1983 NUMBER 180

# Monthly Report on the Nuclear Fuel Market

NUEXCO

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(See inside back cover for list of Representatives and Consultants)

# EXECUTIVE SUMMARY
## REPORT 180

**Exchange Value**
**$24.00, Up $0.50**

The **Exchange Value** as of July 31, 1983 is **$24.00** per pound $U_3O_8$, up 50 cents from last month. Five uranium sales transactions are reported, involving approximately one million pounds $U_3O_8$ *equivalent*. One transaction involved enriched $UF_6$, three involved $U_3O_8$, and the fifth involved natural $UF_6$.

**Supply-Demand Ratio**
**Increased slightly**
**to 2.8:1**

**Active** spot and near-term **uranium supply** amounts to 7.1 million pounds $U_3O_8$, *equivalent*, up 1.1 million pounds from last month. **Active** spot and near-term **uranium demand** rose 13%, to **2.6** million pounds $U_3O_8$ equivalent. Therefore, the spot and near-term **supply-demand ratio** rose slightly, to **2.8.**

**Transaction Value Rose**
**$1.05, to $23.50**

The **Transaction Value** as of July 31, 1983, is **$23.50** per pound $U_3O_8$. It includes 19 transaction involving a total of 2.6 million pounds equivalent $U_3O_8$ and covers a period of five months.

**Conversion Value**
**Declined to $1.10**

The **Conversion Value** as of July 31, 1983 is **$1.10** per pound U as $UF_6$, down 10 cents since last month. No secondary market conversion transactions are reported. Active supply remains approximately four times active demand.

**Loan Use Charge Rate**
**Steady at 6%**

The **Loan Use Charge Rate** as of July 31, 1983 is **6 percent** per annum. No uranium loan transactions are reported.

**SWU Value:**
**FY 84 $95, Down $8**

As of July 31, 1983 the **SWU Value for FY 84** is **$95 per SWU**, down $8 since last month, reflecting prices being offered by sellers of large quantities of Eurodif-origin SWUs in response to USDOE's offer to reduce the SWU price under requirements contracts having 3.5-year termination provisions to the AFC price, currently $11.20 lower than the requirements contract price. Spot and near-term demand for secondary market enrichment services amounts to 630 thousand SWUs. Similarly, active supply of spot and near-term enrichment services in the secondary market amounts to 540 thousand SWUs.

**SWU Transactions**

This issue reports one secondary market sale of enrichment services, involving the sale of 200 thousand Eurodif-origin SWUs from a European entity to a US utility.

**Australia**

Denison has entered into an agreement whereby Aboriginal traditional owners affected by Koongarra development would acquire a 25 percent equity position in the project.

**Europe**

Yugoslavia's domestic austerity program and its efforts to halt the currency outflow may increase Western bankers' confidence enough to improve the nation's ability to finance various projects, including the procurement of uranium.

**Japan**

Review of Japan's recent history with respect to price settlements under long-term contracts suggests that prices for 1983 deliveries by Australia's Queensland Mines will be settled near $35.50.

**Focus: Spain**

Socialist government actions likely to increase Spain's inventory of uranium (currently more than 10 million pounds $U_3O_8$ equivalent) and enrichment (currently more than 6 million SWUs) unless ENUSA sells large quantities of natural uranium and SWUs on the secondary markets.

**South Africa**

Second quarter production by Chamber of Mines members came to 3.9 million pounds $U_3O_8$, 5.7 percent higher than the previous quarter.

**United States**

Some successful achievements of the US nuclear power industry are reviewed (Susquehana 1, McGuire 2, St. Lucie 2, Palo Verde project).

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| NUEXCO REPORT 180 FIGURES OF THE MONTH (July 31, 1983) | This Month (Report 180) | Last Month (Report 179) | 12 Months Ago (Report 168) |
|---|---|---|---|
| Exchange Value[1] | 24.00 | 23.50 | 18.25 |
| Transaction Value[1] | 23.50 | 22.45 | 20.30 |
| Conversion Value[2] | 1.10 | 1.20 | 1.00 |
| Loan Use Charge Rate[3] | 6% | 6% | 6% |
| Near-Term Uranium Supply[4] | 7.1 | 6.0 | 2.6 |
| Near-Term Uranium Demand[5] | 2.6 | 2.3 | 1.0 |
| Near-Term Supply-Demand Ratio | 2.8 | 2.6 | 2.6 |
| Recent Uranium Sales: | | | |
| Number of Transactions[6] | 5 | 4 | 6 |
| Quantity of Material[7] | 0.8-1.5 | 1.3-3.7 | 1.9-3.9 |
| Nuexco SWU Value: | | | |
| FY 84 | 95 | 103 | — |
| USDOE SWU Prices: | | | |
| AFC | 138.65 | 138.65 | 130.75 |
| Requirements | 149.85 | 149.85 | 141.15 |
| Market Value of Enriched $UF_6$[9] [10]: | | | |
| 2.5 w/o $U_{235}$ | 598.47 | 619.44 | — |
| 3.0 w/o $U_{235}$ | 764.27 | 792.80 | — |
| 3.5 w/o $U_{235}$ | 932.90 | 969.24 | — |
| 4.0 w/o $U_{235}$ | 1,103.64 | 1,147.96 | — |

---

[1] US $ per pound $U_3O_8$ equivalent

[2] US $ per pound U as $UF_6$

[3] Per annum

[4] Active inquiries to sell, for delivery within 12 months after contract signing (millions of pounds $U_3O_8$)

[5] Active inquiries to purchase, for delivery within 12 months after contract signing (millions of pounds $U_3O_8$).

[6] Uranium sales only; does not include loans, conversion, or SWU transactions.

[7] Millions of pounds $U_3O_8$, equivalent.

[8] US $ per SWU.

[9] Calculated using the Nuexco Exchange Value, Conversion Value, and 0.20 percent tails assay. Calculations before 2/28/83 used the USDOE price for AFC SWUs. As of 2/28/83, calculations use the Nuexco SWU Value for the relevant fiscal year (currently FY 84).

[10] US $ per KgU as $UF_6$.

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NUEXCO

# MONTHLY REPORT ON THE URANIUM MARKET

August 1983 No. 180

R. WESLEY MILLER, *EDITOR*

*PRICING*

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## FOREWORD

Nuexco will have a suite during the Uranium Institute's Eighth Annual Symposium in London, England. The suite will be located at the Savoy Hotel, August 24-26. We look forward to seeing you in London.

* * *

As of August 1, 1983, Nuexco began transmitting monthly by telex *to all Category I subscribers* a summary of the most-requested current market data published in each month's Report. Please contact Wendy Boyden or Kathie Kuziel in our Menlo Park office to resolve any problems.

## NATURAL URANIUM AND CONVERSION

The **Exchange Value** as of July 31, 1983 is **$24.00** per pound $U_3O_8$, up $0.50 from last month. The *Current Market Data* section of this Report lists five uranium sales transactions, involving approximately 1.0 million pounds $U_3O_8$, *equivalent*. Those sales reflected the ongoing shift of the spot and near-term markets toward an integrated market involving natural $UF_6$, enriched $UF_6$ and enrichment services, as well as $U_3O_8$. One transaction involved enriched $UF_6$, three involved $U_3O_8$, and the fifth involved natural $UF_6$.

**Active spot and near-term uranium supply** ($U_3O_8$ or natural $UF_6$ offered at competitive prices, terms, and other conditions) amounts to **7.1 million** pounds $U_3O_8$ equivalent, up 1.1 million pounds from last month. **Active spot and near-term uranium demand** rose to **2.6 million** pounds $U_3O_8$ equivalent, up from 2.3 million as of June 30. The spot and near-term **supply-demand ratio** was **2.8:1**, slightly higher than last month's level of 2.6.

The **Transaction Value** as of July 31, 1983, is $23.50 per pound $U_3O_8$, equivalent, an increase of $1.05 since last month. The current Transaction Value includes 19 transactions involving a total of 2.6 million pounds $U_3O_8$ equivalent, and covers a period of five months.

* * *

The **Conversion Value** as of July 31, 1983 is **$1.10** per pound U as $UF_6$, down from last month. No secondary market conversion transactions are reported this month.

**Active supply** of secondary market conversion services (active inquiries to sell secondary market conversion services for delivery within the next *three* years) totals **7.0** million pounds U. **Active demand** for secondary market conversion services amounts to **1.8** million pounds U. Active supply remains approximately four times active demand.

* * *

The **Loan Use Charge Rate** remained at six percent per annum. Nuexco is aware of at least three lenders holding a total of more than three million pounds available for loan as $U_3O_8$ at 6 percent per annum, but there are few potential borrowers. No loan transactions are reported this month.

* * *

During July, the Exchange Value drifted upward slightly, but on a generally low level of market activity. The market as of July 31 was characterized by the contrast between large-volume sellers of natural $UF_6$ at prices below the current Exchange Value on one hand and, on the other, discretionary buyers for relatively small quantities of US-origin $U_3O_8$. Finding it difficult if not impossible to deconvert their material, $UF_6$ sellers were not directly competitive with sellers of concentrates. Other factors relevant to the determination of this month's Exchange Value were:

1. Transactions took place at or near the $24.00 level. One large sale of $UF_6$ took place in which the $U_3O_8$ component was priced at the current Exchange Value, but other considerations played a part in the transaction. One small sale of $U_3O_8$ took place at the current Exchange Value. Nuexco knows of at least one buyer willing to pay the current Exchange Value *for concentrates*, but not for the $U_3O_8$ component of $UF_6$.
2. Buyers were generally able to elicit ample interest on the part of sellers, merely by making known their willingness to entertain offers.
3. A great deal of the supply and demand in the market dealt with $UF_6$. Supply of concentrates amounted to 2.6 million pounds $U_3O_8$ and demand for concentrates amounted to 1.6 million pounds $U_3O_8$. However, only three sellers were offering concentrates in large enough quantities to satisfy the smallest of the four items of demand for concentrates. Thus, although overall concentrate supply still out-weighed overall concentrate demand, the individual buyers and sellers were somewhat mismatched.
4. Some discretionary buying activity took place, stimulated by some buyers' relatively low cost of money combined with expectations of rising prices.
5. Finally, July saw the continuation of a trend that has been evident for several months, namely a growing consensus that prices "ought to be higher." There seems to be little buyer resistance to the gradual increases which have occurred since the low point reached in the fall of 1982. Thus, prices appear to be drifting upward, as opposed to being driven upward by aggressive buying.

## ENRICHED URANIUM AND SWUS

As of July 31, 1983 the SWU value for FY 1984 is $95 per SWU, down $8 from last month, once again reflecting the prices offered by sellers of large quantities of Eurodif-origin SWUs. The drop of $8 since last month reflects their response to USDOE's offer to reduce the SWU price under requirements contracts having 3.5-year termina-

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## PRICING

tion provisions to the AFC price, currently $11.20 lower than the requirements contract price.

As of July 31, spot and near-term demand for secondary market enrichment services amounted to 630 thousand SWUs. Active supply of spot and near-term enrichment services in the secondary market amounted to 540 thousand SWUs. The *Current Market Data* section reports one transaction for secondary market enrichment services, involving the sale of 200 thousand Eurodif-origin SWUs from a European entity to a US utility.

* * *

Activity in the secondary market for enrichment services was dominated by USDOE's frantic efforts to maintain market share. Having discovered that some DOE customers (holders of requirements contracts containing 3.5-year termination provisions) could save substantial amounts of money by partially terminating their DOE contracts, paying the DOE termination charges (10 to 25 percent, as opposed to 40 percent for contracts having 5-year termination provisions), and replacing those SWUs on the secondary market, DOE responded with the Interim Sales Contract (ISC) to induce them to forego the secondary market opportunity.

At a time when $1.8 billion already had been spent on the new Portsmouth centrifuge plant, DOE had lost about $1 billion worth of business in SWU contract terminations, and $470 million were still at risk over the next three years under contracts with nine customers. In the first of several tactics planned "to try and rationalize the market", DOE needed to offer prices which, given the current termination charges, would eliminate any significant incentive for a DOE customer to turn to the secondary market. Following negotiations with Philadelphia Electric Company and after some hesitations caused by legal issues, DOE offered the ISC to all holders of requirements contracts having 3.5-year termination provisions. Under the ISC, a DOE customer would waive the right to terminate the contract and would commit to take all enrichment requirements from DOE. In return, DOE would reduce that customer's SWU price for FY83-FY85 (currently $149.85) to the fixed-commitment contract price (currently $138.65) and increase their current 30-day payment term to 60 days.

The secondary market price for SWUs dropped by $8 as a direct consequence of DOE's offering of the ISC. With a 25 percent termination charge, currently $37.46, and a new secondary market price of X, a utility willing to terminate a 3.5-year requirements contract would end up paying $( 37.46 + X ) per SWU. Under the terms of the ISC, the same customer would pay only $138.65 per SWU (current fixed-commitment price). It is Nuexco's observation that, to give any utility some incentive to consider the secondary market, a profit of at least $6-7 should be possible. A mathematical translation of this statement is: ( 138.65 ) - ( 37.46 + X ) must be greater than or equal to $6 to $7, or X must be less than or equal to 138.65 - 37.46 - (6 to $7) = $94.19 to $95.19. Thus, any sellers of secondary market SWUs asking for more than $94-95 are not apt to be very successful. Hence, the SWU Value of $95 for FY84.

The effect of the DOE's offer of the ISC has been to reduce the break-even price from $112.39 to $101.19, although no termination for FY 83-85 SWUs will be allowed if the affected DOE customers decide to accept the ISC. Transactions unaffected by the ISC are all those that do not depend on a partial contract termination by a holder of a DOE requirements contract having 3.5-year termination provisions. Those include:

1. DOE-origin/DOE-origin
2. Eurodif-origin/Eurodif-origin
3. Sales of DOE-origin SWUs to non-DOE customers.

Decisions by DOE customers holding requirements contracts having 3.5-year termination provisions to accept or decline the ISC will be based on several factors:

1. By accepting the ISC, a customer would obtain a guaranteed saving ($11.20 per SWU for FY83; indeterminate for FY84 and FY85).
2. In exchange, that same customer would surender the opportunity to obtain an even greater saving on the secondary market. Given the tremendous excess of secondary market SWUs, the course of action likely to yield the greatest benefit to shareholders and ratepayers is far from certain.
3. To the extent that a customer accepts the ISC in order to support DOE as its primary supplier of enrichment, that customer would be paying $6-$7 per SWU more than if the SWUs were bought on the secondary market.

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## *CURRENT MARKET DATA*

**EXCHANGE VALUE $24.00/lb. $U_3O_8$**
Determined as of July 31, 1983

**Definition**[1]
The Exchange Value is Nuexco's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the last day of the month.

**Derivation**
Nuexco bases the Exchange Value upon:
A. Data from recently completed transactions.
B. Data from pending transactions.
C. Firm bids to buy and firm offers to sell.
D. Prices purchasers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy, and prices sellers have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell.

**Comments**
Nuexco does not consider the following in determining the Exchange Value:
A. The price of uranium delivered or to be delivered under old contracts.
B. The price of uranium delivered in connection with contract renegotiations or other than arm's length transactions.

[1] In December, 1981, Nuexco published a history of the Exchange Value which chronicled, month-by-month, changes in its definition, usage and derivation. Copies are available upon request.

**TRANSACTION VALUE**[2]
Determined as of July 31, 1983

| $/lb. $U_3O_8$ | Millions of Pounds | Number of Transactions | Number of Months |
|---|---|---|---|
| 23.50 | 2.6 | 19 | 5 |

**Definition**
The Transaction Value is a weighted average price of recent transactions, and is based on prices paid for $U_3O_8$ in transactions closed within the previous three-month period and for which delivery was scheduled within one year of the transaction date. At least ten transactions totaling at least two million pounds $U_3O_8$ are included in each calculation, or the sample time is extended as necessary to include these minima. Foreign currencies are converted to US dollars as of the transaction date.

**Comments**
Nuexco does not consider the following in determining the Transaction Value:
A. The price of uranium delivered in connection with contract renegotiations or other than arm's length transactions.
B. The price of uranium delivered in connection with contracts which call for "market price" mechanisms. This exclusion applies particularly to contracts in which delivery prices are expressed as a function of Exchange Value or any other independent variable. Also excluded from consideration are all data where the delivery price is defined in such a way that it cannot currently be determined.

[2] Transaction Values for 1976 through 1981 and their associated parameters (millions of pounds, number of transactions and number of months) are tabulated on pages 31 and 32 of Report 161. Corresponding data for 1982 are tabulated on page 5 of Report 173.

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*CURRENT MARKET DATA*

**CONVERSION VALUE[1] $1.10/lb. U as $UF_6$**
Determined as of July 31, 1983

**Definition**

The Conversion Value is Nuexco's judgment of the price at which spot and/or near-term transactions for significant quantities of conversion services could be concluded in the secondary market as of the last day of the month.

**Derivation**

Nuexco bases the Conversion Value upon:

A. Data from recently completed transactions.
B. Data from pending transactions.
C. Firm bids to buy and firm offers to sell.
D. Prices purchasers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy, and prices sellers have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell.

**Comments**

Nuexco does not consider the following in determining the Conversion Value:

A. The price of conversion services delivered or to be delivered under old contracts.
B. The price of conversion services delivered in connection with contract renegotiations or other than arm's length transactions.

[1] Monthly data for 1981 and 1982 are tabulated on page 6 of Report 173.

**LOAN USE CHARGE RATE[2] 6%**
Determined as of July 31, 1983

**Definition**

The Loan Use Charge Rate is Nuexco's judgment of the annual interest rate at which uranium loans could be concluded as of the last day of the month.

**Derivation**

Nuexco bases the Loan Use Charge Rate upon:

A. Data from recently completed or pending loan transactions.
B. Rates included in firm proposals to borrow or lend.
C. Rates that potential borrowers and lenders have expressed as a willingness to pay or accept, but for which Nuexco is not aware of firm proposals.

[2] Monthly data for 1968 through 1981 appear on pages 32-34 of Report 162. Monthly data for 1982 appear on page 2 of Report 173.

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*CURRENT MARKET DATA*

**SWU VALUE $95/SWU for FY84**
Determined as of July 31, 1983

**Definition**

The SWU (Separative Work Unit) Value is Nuexco's judgment of the price, expressed in US dollars per SWU, at which transactions for the sale of significant quantities of SWU of any origin for delivery in the specified DOE fiscal year could be concluded as of the last day of the month.

**Derivation**

Nuexco bases the SWU Value upon:

A. Data from recently completed transactions.
B. Data from pending transactions.
C. Firm bids to buy and firm offers to sell.
D. Prices purchasers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy, and prices sellers have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell.
E. SWU prices at varying tails assays and varying product assays are converted to the equivalent SWU price at the DOE Reference Transaction Tails Assay (presently 0.20 weight percent $U_{235}$) and a product assay of three percent $U_{235}$ assuming feed costs calculated using the Nuexco Exchange Value and Nuexco Conversion Value determined as of the last day of the same month.

**Comments**

Nuexco does not consider the following in determining the SWU Value:

A. The price of SWU delivered under long-term contracts from primary suppliers, such as DOE, Urenco, or Eurodif.
B. The price of SWU delivered under other than arm's length transactions.

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*CURRENT MARKET DATA*

## EXCHANGE VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

| Country (currency) | per lb. $U_3O_8$ in Concentrates | per kg $U_3O_8$ in Concentrates | per kg U in Concentrates |
|---|---|---|---|
| Australia (dollar) | 27.27 | 60.12 | 70.89 |
| Belgium (comm. franc) | 1,263 | 2,785 | 3,284 |
| Canada (dollar) | 29.57 | 65.20 | 76.89 |
| Finland (markka) | 134.83 | 297.25 | 350.53 |
| France (franc) | 189.72 | 418.27 | 493.24 |
| FRG (mark) | 63.19 | 139.31 | 164.28 |
| Italy (lira) | 37,383 | 82,416 | 97,188 |
| Japan (yen) | 5,780 | 12,743 | 15,028 |
| Netherlands (guilder) | 70.44 | 155.30 | 183.14 |
| South Africa (rand) | 26.37 | 58.14 | 68.57 |
| Spain (peseta) | 3,582 | 7,897 | 9,313 |
| Sweden (krona) | 185.04 | 407.95 | 481.07 |
| Switzerland (franc) | 50.92 | 112.27 | 132.39 |
| UK (pound) | 15.72 | 34.65 | 40.86 |
| US (dollar) | 24.00 | 52.91 | 62.39 |

## TRANSACTION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

| Country (currency) | per lb. $U_3O_8$ in Concentrates | per kg $U_3O_8$ in Concentrates | per kg U in Concentrates |
|---|---|---|---|
| Australia (dollar) | 26.70 | 58.87 | 69.42 |
| Belgium (comm. franc) | 1,237 | 2,727 | 3,216 |
| Canada (dollar) | 28.96 | 63.84 | 75.29 |
| Finland (markka) | 132.02 | 291.06 | 343.23 |
| France (franc) | 185.77 | 409.55 | 482.96 |
| FRG (mark) | 61.87 | 136.41 | 160.86 |
| Italy (lira) | 36,604 | 80,699 | 95,163 |
| Japan (yen) | 5,660 | 12,478 | 14,715 |
| Netherlands (guilder) | 68.98 | 152.07 | 179.32 |
| South Africa (rand) | 25.82 | 56.93 | 67.14 |
| Spain (peseta) | 3,507 | 7,733 | 9,119 |
| Sweden (krona) | 181.19 | 399.45 | 471.05 |
| Switzerland (franc) | 49.86 | 109.93 | 129.63 |
| UK (pound) | 15.39 | 33.93 | 40.01 |
| US (dollar) | 23.50 | 51.81 | 61.09 |

[1] Calculated using currency exchange rates published in the Wall Street Journal on July 29, 1983.

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## CONVERSION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

| Country (currency) | per lb. U as UF6 | per kg U as UF6 |
|---|---|---|
| Australia (dollar) | 1.25 | 2.76 |
| Belgium (comm. franc) | 57.89 | 127.64 |
| Canada (dollar) | 1.36 | 2.99 |
| Finland (markka) | 6.18 | 13.62 |
| France (franc) | 8.70 | 19.17 |
| FRG (mark) | 2.90 | 6.39 |
| Italy (lira) | 1,713 | 3,777 |
| Japan (yen) | 264.93 | 584.08 |
| Netherlands (guilder) | 3.23 | 7.12 |
| South Africa (rand) | 1.21 | 2.66 |
| Spain (peseta) | 164.18 | 361.95 |
| Sweden (krona) | 8.48 | 18.70 |
| Switzerland (franc) | 2.33 | 5.15 |
| UK (pound) | 0.72 | 1.59 |
| US (dollar) | 1.10 | 2.43 |

## SWU VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

| Country (currency) | FY 1984 per SWU |
|---|---|
| Australia (dollar) | 107.94 |
| Belgium (comm. franc) | 5,000 |
| Canada (dollar) | 117.07 |
| Finland (markka) | 533.71 |
| France (franc) | 750.99 |
| FRG (mark) | 250.13 |
| Italy (lira) | 47,975 |
| Japan (yen) | 22,881 |
| Netherlands (guilder) | 278.84 |
| South Africa (rand) | 104.40 |
| Spain (peseta) | 14,179 |
| Sweden (krona) | 732.46 |
| Switzerland (franc) | 201.57 |
| UK (pound) | 62.21 |
| US (dollar) | 95.00 |

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[1] Calculated using currency exchange rates published in the Wall Street Journal on July 29, 1983.

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*CURRENT MARKET DATA*

## RECENT TRANSACTIONS[1]

**Uranium Sales**

| Nuexco Transaction Number | Delivery Period | Approximate Quantity (thousands of pounds, $U_3O_8$ equivalent) | Approximate Price as Percent of Current E.V. | Seller | Buyer | Remarks |
|---|---|---|---|---|---|---|
| 2357 | 1983 | 101-300 | 99 | US Producer | US Utility | $UF_6$ |
| 2366 | 1984 | 601-1000 | 99 | European Entity | US Utility | Enriched $UF_6$ |
| 2411 | 1983 | 51-100 | 99 | US Producer | US Producer | |
| 2414 | 1983 | Less than 50 | 96 | European Producer | European Utility | |
| 2423 | 1983 | Less than 50 | 99 | US Producer | US Utility | |

**Uranium Loans** none reported

**Secondary Market Conversion Services** none reported

**Secondary Market Enrichment Services**

| Nuexco Transaction Number | Delivery Period[2] | Approximate Quantity (thousands of SWUs) | Approximate Price[3] as Percent of Current SWU Value | Tails Assay (Percent $U_{235}$) | Buyer Group | Seller Group | SWU Origin | Remarks |
|---|---|---|---|---|---|---|---|---|
| 2404 | 3Q85-4Q87 | 200 | 117-138 | 0.20-0.30 | US Utility | European Entity | Eurodif | |

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[1] Transactions listed are not limited to those in which Nuexco was involved, but also include others of which Nuexco is aware.

[2] Q refers to quarter of calendar year, not fiscal year.

[3] Price is not normalized to 0.20% tails assay.

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## URANIUM SUPPLY
### (As of 7/31/83)

| Nuexco Project Number | Delivery Period[1] (Thousands of Pounds $U_3O_8$) | | Remarks |
|---|---|---|---|
| | Spot or Near-term[2] | Intermediate or Long-term[3] | |
| **Available for Sale:** | | | |
| **ACTIVE** | | | |
| 1575 | | 500 per year | Long Term |
| 1818 | | 250 per year | Long Term |
| 2017 | | 2,300 | |
| 2038 | 2,000 | | $UF_6$ |
| 2134 | | 300 per year | 1984 on |
| 2162 | 40 | | $UF_6$ |
| 2191 | 125 | | $UF_6$ |
| 2193 | | 800 per year | 1986-90 |
| 2201 | 30 | | |
| 2203 | 1,200 | | |
| 2219 | 200 | | Enriched $UF_6$ |
| 2220 | 150 | | $UF_6$ |
| 2235 | | 100 per year | 1985-87 |
| 2236 | | 200 per year | 1985-89 |
| 2246 | 40 | 100 | |
| 2275 | 90 | | |
| 2277 | 200 | | $U_3O_8$ or $UF_6$ |
| 2288 | 80 | | $UF_6$ |
| 2297 | 60 | 200 per year | 1985-89 |
| 2299 | 130 | | $UF_6$ |
| 2300A | 35 | | |
| 2307 | 900 | | $UF_6$ |
| 2309 | 1,000 | | |
| 2315 | 450 | | $UF_6$ |
| 2315A | | 950 | $UF_6$ |
| 2320 | 350 | | $UF_6$ |
| TOTAL: | 7,080 | | |
| **INACTIVE** | | | |
| 1877 | 40 | | |
| 2121 | 600 | | |
| 2196 | 500 | | |
| 2271 | | 500 per year | 1984-88 |
| TOTAL: | 1,140 | | |

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[1] Measured from the date of this Report

[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

[3] For delivery beyond one year.

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*CURRENT MARKET DATA*

## URANIUM DEMAND
## (As of 7/31/83)

| Nuexco Project Number | Delivery Period[1] (Thousands of Pounds $U_3O_8$) | | Remarks |
|---|---|---|---|
| | Spot or Near-term[2] | Intermediate or Long-term[3] | |
| **Inquiries to Purchase:** | | | |
| **ACTIVE** | | | |
| 1459 | | 200 per year | 1985 on |
| 1996 | 400 | | |
| 2010 | | 400 per year | 1984-92 |
| 2167 | 250 | 250+ per year | 1984-99 |
| 2187 | 200 | | |
| 2188 | | 250 per year | 1985 on |
| 2233 | 700 | | 1984, $U_3O_8$ or $UF_6$ |
| 2304 | | 500 per year | 1988 on<br>enriched $UF_6$ |
| 2310 | 1,000 | | |
| 2313 | | 200 | |
| TOTAL: | 2,550 | | |
| **INACTIVE** | | | |
| 1999 | | 50 per year | 1985-90 |
| 2025 | | 350 | |
| 2114 | | 75 per year | 1984 on |
| 2115 | | 200 per year | 1986 on |
| 2214 | 400 | | $UF_6$ |
| 2244 | | 350 per year | 1985 on |
| 2278 | 250 | | $U_3O_8$ or $UF_6$ |
| TOTAL: | 650 | | |

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[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

[3] For delivery beyond one year.

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## CONVERSION SUPPLY
## (As of 7/31/83)

| Nuexco Project Number | Delivery Period[1] (Thousands of Pounds U as $UF_6$) Within 3 Years | Beyond 3 Years | Remarks |
|---|---|---|---|
| **ACTIVE** | | | |
| 1609 | 1,500 | | |
| 1840 | 130 | | |
| 1936 | 1,500 | 200 per year | Long Term |
| 2051 | 1,500 | | |
| 2141 | 1,500 | | |
| 2143 | 400 | | |
| 2220 | 400 | | |
| 2222 | 100 | 175 | |
| TOTAL: | 7,030 | | |
| **INACTIVE** | | | |
| 2181 | 650 | 650 per year | Long Term |
| 2230 | 300 | | |
| TOTAL: | 950 | | |

## CONVERSION DEMAND
## (As of 6/30/83)

| Nuexco Project Number | Delivery Period[1] (Thousands of Pounds U as $UF_6$) Within 3 Years | Beyond 3 Years | Remarks |
|---|---|---|---|
| **ACTIVE** | | | |
| 2129 | 900 | | |
| 2135 | 400 | 135 per year | 1986-87 |
| 2199 | 450 | 300 per year | 1986 on |
| 2188 | | 225 per year | 1985 on |
| TOTAL: | 1,750 | | |
| **INACTIVE** | | | |
| 2190 | 400 | 200 per year | 1986 on |
| 2194 | | 300 per year | 1986 on |
| 2295 | 250 | | |
| TOTAL: | 650 | | |

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[1] Measured from the date of this Report.

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*CURRENT MARKET DATA*

## LOAN SUPPLY AND DEMAND
## (As of 7/31/83)

| Nuexco Project Number | Delivery Period[1] (Thousands of Pounds $U_3O_8$) |  | Remarks |
|---|---|---|---|
|  | Within 1 Year | Beyond 1 Year |  |
| **Available for Loan:** **ACTIVE** |  |  |  |
| 1815 | 1,000 |  | $UF_6$ |
| 1938 | 1,500 |  | $UF_6$ |
| 2128 | 2,500 |  |  |
| TOTAL: | 5,000 |  |  |
| **INACTIVE** |  |  |  |
| 1884 | 600 |  |  |
| 2036 | 500 |  | $UF_6$ |
| 2139 | 2,000 |  |  |
| TOTAL: | 3,100 |  |  |
| **Inquiries to Borrow:** **ACTIVE** |  |  |  |
| 1998 | 200 | 200 |  |
| 2006 | 600 |  |  |
| 2118 | 250 |  | $U_3O_8$ or $UF_6$ |
| TOTAL: | 1,050 |  |  |
| **INACTIVE** | None |  |  |

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[1] Measured from the date of this Report

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## ACTIVE SWU SUPPLY
(As of 7/31/83)

| Nuexco Project Number | Delivery Period[1] (Thousands of SWUs) | |
|---|---|---|
| | Spot or or Near-term[2] | Intermediate or Long-term[3] |
| 1859 | — | 5,000 |
| 1971 | — | 250 |
| 1984 | 120 | — |
| 2100 | — | 400 |
| 2168 | 170 | 430 |
| 2192 | — | 410 |
| 2285 | 250 | 6,000 |
| TOTAL: | 540 | |

## ACTIVE SWU DEMAND
(As of 7/31/83)

| Nuexco Project Number | Delivery Period[1] (Thousands of SWUs) | | Remarks |
|---|---|---|---|
| | Spot or or Near-term[2] | Intermediate or Long-term[3] | |
| 1850 | — | 500 | |
| 1856 | — | 500 | |
| 1860 | 240 | — | |
| 2117 | — | 400 | |
| 2233 | 250 | — | |
| 2237 | — | 150 per year | 84 and beyond |
| 2308 | 140 | — | |
| TOTAL: | 630 | | |

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

[3] For delivery beyond one year.

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*RECENT DEVELOPMENTS*

## AUSTRALIA

Denison has entered into an agreement whereby the affected Aboriginal traditional owners would acquire a 25 percent equity position in the Koongarra project. Aboriginal representatives have informed the government of their desire to participate in the project, implying that the development of Koongarra should proceed. This move creates a dilemma for the ALP (Australian Labor Party).

If Denison is not allowed to proceed with Koongarra, the ALP claim to support the socially vulnerable becomes hollow, especially insofar as it applies to Aboriginal interests. As the affected Aboriginal community sees in the equity holding an opportunity for self-determination and growing independence from government welfare payments, a decision to prohibit Koongarra's development could be politically embarrassing for the ALP. On the other hand, if Koongarra is allowed to proceed, the apparent violation of the party's platform provision calling for a "phasing out" of the uranium producing industry could cause more internal dissension over its uranium policies.

At present, it seems that the Australian government's only practical choice is to approve all uranium developments or none. This dilemma could generate bipartisan pressure for a more pragmatic national policy toward uranium development in Australia.

1. If Aboriginal interests take up 25 percent of the equity in the project, Denison will still need to place another 50 percent with Australian interests in order to meet the guidelines of 75 percent domestic ownership.

2. Denison will still face the handicaps imposed by Australia's confused political policies. Until prospective buyers believe contracts with Australian producers will not be repudiated by politicians, Denison will find it difficult to represent itself as a reliable supplier.

3. Finally, if they can overcome these and other hurdles, Denison will still face the need to compete for market share in a uranium market characterized by excess production capacity, excess supply, and low prices. However, it should be noted that Denison's Canadian parent has an already established market position which, if transfer pricing and other problems could be solved, might ease the market entry problem.

While there is no denying the existence of substantial political and marketing uncertainties, the combination of the Aboriginal interest and a well-known Canadian producer having an established market position raises some encouraging possibilities. It is Nuexco's opinion that Denison will eventually overcome all of the obstacles to Koongarra's development and begin producing uranium. However, it is premature to speculate on the time frame in which that development will take place.

## EUROPE

There is continued cautiously optimistic economic news from **Yugoslavia** which may indirectly affect the nuclear activity in that country. The Organization for Economic Cooperation and Development (OECD) recently praised Yugoslavia for its domestic austerity program and its attempt to halt the negative currency flow. This favorable report should increase the confidence of Western bankers in Yugoslavia and improve the nation's ability to finance various projects, including the procurement of uranium.

In the past, Yugoslavia has suffered from a serious foreign currency deficit, and this has made the task of purchasing uranium more difficult. Originally, it was intended that both the currently operating Krsko nuclear plant and the still planned Prevlaka plant would be supplied by domestically produced uranium. However, the Yugoslavian production facility will not come on line until the mid-1980s, and in the interim the operating Krsko plant has had to turn to foreign sources for its reloads. Due to the foreign currency crisis, Krsko has been forced to purchase uranium only as needed, and through the use of creative payment terms such as payment in the form of electricity or Yugoslavian goods and services.

With the improved financial climate and the impending startup of domestic production, however, Yugoslavia may be in a position to consider a more farsighted uranium supply policy. With Krsko running increasingly well, and thus consuming substantial amounts of fuel, it is conceivable that the Yugoslavians might use their improved economic situation to establish a procurement program based on hard currency purchases of foreign supplies until domestic production begins supplying sufficient uranium.

On the negative side, it should be noted that the OECD report refers to significant short-term problems that Yugoslavia faces in attempting to curb the nation's inflation, currently running at an annual rate of 35 percent.

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Also, there is a sizeable group of Yugoslavians who feel that in the face of continued inflation, reduced real average wages, and alarmingly high foreign indebtedness, it may be an inopportune time to pursue an aggressive nuclear policy. As in several other European countries, the gradual resurgence of nuclear power is tempered by the still difficult general economic situation.

## JAPAN

The disparity between spot/near-term prices and longer-term prices, though somewhat mitigated by recent increases, continues to exert pressure for price reductions under Japan's long-term uranium contracts. However, Japanese uranium buyers, ever conscious of security-of-supply considerations, remain reluctant to press their suppliers for maximum concessions, hesitating to risk any disruption of these long-term relationships. Nevertheless, they are influenced somewhat by developments in the spot/near-term market. Over the past few years, that influence has led to the negotiation of successively lower prices.

Almost all of Japan's long-term uranium supply contracts provide for annual price negotiations. (An exception to this general practice is Energy Resources of Australia, where the formula-based price is more than $38.00.) Some of these are conducted in the year prior to the year of delivery, while others are conducted contemporaneously with delivery. Historically, the final prices negotiated for a given delivery year have fallen into a relatively narrow range regardless of when negotiated. Thus, 1982 negotiations for 1983 deliveries were settled in the range of $35.35 to $35.40 per pound $U_3O_8$, and only recently a Canadian producer settled for 1983 deliveries at a price of $35.50. Accordingly, it seems likely that prices for 1983 deliveries by Australia's Queensland Mines will be settled at a similar level.

The continued downtrend from year to year is illustrated by the 1983 negotiations that have been conducted for 1984 deliveries. As indicated in Report 176, most of those were settled in the range of $33.00 to $34.25 per pound $U_3O_8$. The increasing strength of the US dollar will cause some, priced in other currencies, to be effectively even lower.

## SOUTH AFRICA

Uranium production from South African gold-uranium operations for second quarter 1983 and year-to-date is itemized in Table 1.

**Table 1**

**REPUBLIC OF SOUTH AFRICA: URANIUM PRODUCTION FROM GOLD-URANIUM OPERATIONS (Thousands of Pounds $U_3O_8$)**

| Operation | Second Quarter 1983 | Year to Date |
|---|---|---|
| Blyvooruitzicht | 185 | 334 |
| Buffelsfontein | 342 | 646 |
| Chemwes | 297 | 565 |
| Dreifontein Consolidated | 88 | 196 |
| ERGO | 134 | 277 |
| Harmony | 363 | 729 |
| Hartebeesfontein | 241 | 475 |
| JMS | 384 | 755 |
| Randfontein | 262 | 532 |
| St. Helena (BEISA) | 233 | 431 |
| Vaal Reefs | 1,083 | 2,101 |
| Western Areas | 158 | 290 |
| Western Deep Levels | 94 | 188 |
| TOTAL | 3,864 | 7,519 |

Table 1 includes all of South Africa's uranium producers except for Palabora Mining Company (PMC) which is not a member of the Chamber of Mines. Total second quarter production of approximately 3.9 million pounds $U_3O_8$ was 5.7 percent higher than the previous quarter's output, primarily due to increases of 6.4 percent at Vaal Reefs, 12.3 percent at Buffelsfontein, 24.7 percent at Blyvooruitzicht, 10.8 percent at Chemwes, and approximately 20 percent at St. Helena (BEISA).

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*RECENT DEVELOPMENTS*

## UNITED STATES

At a time when financial difficulties and delays are plaguing many projects, it may be worthwhile to consider some successful achievements of the US nuclear power industry.

1. Susquehanna Unit 1 is jointly owned by Pennsylvania Power and Light Company (90 percent) and Allegheny Electric Company (10 percent). Located near Berwick, Pennsylvania, this plant is a 1,050-MWe (net) boiling water. reactor (BWR) designed by General Electric. Susquehanna Unit 1 was granted a fuel loading license in May 1982, a low power operating license in July 1982, and a full power operating license in November 1982. The reactor began commercial operations on June 8, 1983 and operated with a 56.5 percent capacity factor for that first month.

2. McGuire Unit 2 is a 1,180-MWe (net) pressurized water reactor (PWR) owned by Duke Power Company, designed by Westinghouse and located near Cornelius, northwest of Charlotte, North Carolina. On March 3, 1983, the NRC (Nuclear Regulatory Commission) staff issued a license to Duke Power Company for fuel loading and low power (5 percent) testing of McGuire Unit 2. The utility is expecting that this plant will go into commercial operation around March 1984. A full power license was obtained in May 1983 and the reactor operated in June with a 11.5 percent capacity factor. McGuire Unit 1, essentially identical to Unit 2, has been in commercial operation since December 1981.

3. St. Lucie Unit 2. 85 percent owned by Florida Power and Light Company, is a 777-MWe (net) PWR designed by Combustion Engineering and located on Hutchinson Island, Florida. In spite of extra regulations and new requirements, it took about the same time to build Unit 2 as it did for Unit 1. On April 6, 1983, only five years and eight months after construction started, St. Lucie Unit 2 was granted a license by the NRC for fuel loading and low power testing. That was followed by a full power operating license in June 1983. This achievement has been attributed to an innovative approach to plant construction and an efficient planning and scheduling system. Florida Power and Light took control from the start by assuming responsibility for the construction site management of the Unit 2 project. The start-up team was brought in at a very early stage in 1979 and equipment testing was initiated in completed areas as construction was proceeding. The utility is expected to bring St. Lucie Unit 2 on line in the first part of 1984.

4. Another positive note is the progress on the Palo Verde project owned by Arizona Public Service, Salt River Project, El Paso Electric Company, and Southern California Edison. Located near Wintersburg, Arizona, the Palo Verde project includes three identical 1,270-MWe (net) PWRs designed by Combustion Engineering as part of the System 80 series. Fuel loading of Palo Verde-1 is scheduled for November 1983. The NRC may issue a full power license for this unit in October of this year, in which case the utility would be planning to bring the reactor on line in May 1984, seven years and eleven months after construction started. Utility predictions indicate that Palo Verde Unit 1 could be the first System 80 reactor in service, although its schedule ranked it twelfth in 1976. One cautionary note—in late July, APS discovered damage to reactor coolant pumps and cracks in the control rod drive mechanisms' upper guide structure. The significance of those problems was not clear at press time, but delays of several weeks or longer are likely.

Two other plants are predicated to begin operations in 1983 in addition to Susquehanna Unit 1: they are Grand Gulf Unit 1, a 1250-MWe (net) General Electric BWR owned by Mississippi Power and Light Company, and Virgil Summer, a 900-MWe (net) Westinghouse PWR owned by South Carolina Electric and Gas Company. San Onofre Unit 2, a 1,100-MWe (net) Combustion Engineering PWR owned by Southern California Edison Company, is also scheduled to restart in 1983. As a result of these and other anticipated events, the Department of Energy estimates that 1983 will see a six percent increase in the nuclear generation of electricity.

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## URANIUM DEMAND AND SUPPLY IN SPAIN

### Introduction

Spain once planned to rely heavily on nuclear power for electricity generation, such that seventeen nuclear units comprising more than 14,600 MWe (net) were to have been operating by the mid-1980s. Reduced forecasts of load growth, escalating construction costs and a heavy foreign debt burden, among other factors, have led Spain's Socialist government to plan the indefinite deferral of six to eight units accounting for 5,847 MWe and 7,861 MWe. Thus, Spain's current plans call for nuclear generating capacity of less than half the amount originally planned to be operating by the end of this decade. A review of the historical background of Spain's nuclear power program will reveal some of the causes of the problems being encountered today.

### National Energy Plans

From the 1950s to the early 1970s, Spain experienced an industrial boom, resulting in an economic growth rate of over 5 percent per year for the period. With this growth came a dependence on imports for more than 70 percent of the nation's fuel in 1973. As a result of the oil crisis that year, the government decided to base its energy policies on a national energy plan, its purpose being the prudent management of Spain's natural resources and the promotion of an independent energy program. Spain's first national energy plan, based on an annual growth rate of over 5 percent, was prepared in 1975. The most pessimistic of the several growth scenarios called for a 3.0 percent annual growth rate for the 1983-85 period and 3.5 percent for 1986 to 1990. Under this program, 70 percent of the nation's annual power needs were to be generated by coal and uranium by 1990. In 1973, coal and uranium together supplied less than 20 percent of Spain's primary energy. (That figure was 47.1 percent in 1982.) Table 1 lists the nuclear units proposed under that first plan.

Based on the assumed needs for electricity, that first plan proposed the addition of 12 nuclear units having combined capacity of 11,551 MWe net. Those units are listed in Table 1.

**Table 1**

**ADDITIONAL NUCLEAR UNITS PROPOSED BY SPAIN'S FIRST NATIONAL ENERGY PLAN**

| Unit | MWe (net) |
|---|---|
| Almaraz I and II | 1,860 |
| Lemoniz I and II | 1,860 |
| Asco I and II | 1,860 |
| Cofrentes I | 975 |
| Valdecaballeros I and II | 1,950 |
| Trillo I and II | 2,064 |
| Vandellos II | 982 |
| TOTAL | 11,551 |

Three units, comprising 1,020 MWe, were already operating at the time, so that first plan called for a total of 15 nuclear units having a combined capacity of 12,571 MWe. Subsequent plans added two more units (Regodola and Sayago, comprising 2,075 MWe net) for a total planned nuclear capacity of 14,646 MWe net.

The preparation of the national energy plan and its revision are assigned to the Ministry of Industry and Energy, and more specifically to its Commissioner of Energy and Natural Resources. Early in January 1983, the then-new Socialist government established a committee for the revision of the plan, with a membership composed of the following officials:

1. Sr. Martin Gallego—Commissioner of Energy;
2. Sra. Carmen Mestre—Director General Energy;
3. Sr. Juan Manuel Kindelan—Director General Mines;
4. Sr. Juan Tesora—Engineering Dept. ENDESA (Empresa Nacional de Electrica S.A.—owned by INI);
5. Sr. Feliciano Fuster—President GESA (General Electric S.A.);
6. Sr. Roberto Centeno—Director General CAMPSA (Compania Arendardaria del Monopolio de Petrolio S.A.—scheduled to be disbanded before the end of 1983).

Although the committee had not yet submitted to Parliament its revised energy plan, Carmen Mestre, Director General for Energy, had made public some of the committee's conclusions.

1. The government is basing its forecasts of electricity demand on an annual growth rate of 3.5-4.0 percent.
2. Nuclear power is projected to supply a 10 percent share of primary energy consumption by 1990, as compared to an average of 20 percent for the rest of Europe by that date.

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3. The government considers installed nuclear capacity of 6,700 MWe by 1990 to be sufficient when combined with increases in hydro and coal-fired facilities.

4. In order to meet its announced goal of approximately 6,700 MWe nuclear capacity installed by 1990, the government will authorize the startup of Cofrentes, Asco Unit II and one of the three units: Valdecaballeros I; Trillo I; Vandellos II.

5. Six units are indefinitely deferred—Valdecaballeros II; Lemoniz I and II; Regodola; Sayago; Trillo II.

In recent months Spain's Socialist government has given signals that it may be reconsidering the role nuclear power should play in the next revision of the national energy plan. Public announcements by Energy Director General Carmen Mestre had indicated that the government favored a national energy plan that would have minimized the role of nuclear power. However, after the Socialists' May 8 success in municipal elections, the Minister of Industry and Energy, Carlos Solchaga, dismissed the committee of experts who had been reviewing the plan. Reasoning that a minimized role for nuclear power would hinder the stimulation of the economy and the creation of jobs, a primary political objective of the Socialist party, the government will take those factors into account in the revision of the national energy plan. The publication of the plan will be delayed by the process of reconsidering those factors. It is reasonable to hope that Valdecaballeros I, Trillo I and Vandellos II will all be allowed to proceed.

Table 2 summarizes the status of nuclear power plants in Spain.

Table 2
NUCLEAR POWER PLANTS IN SPAIN

| | Utility | Reactor Type | Capacity (Net MWe) | Commercial Operation | % Complete |
|---|---|---|---|---|---|
| **Operating** | | | | | |
| Zorita[1] | Union Electrica | PWR | 160 | 3Q68 (Actual) | |
| Garona | Nuclenor | BWR | 460 | 4Q70 (Actual) | |
| Vandellos I | HIFRENSA[2] | GCR | 500 | 1Q72 (Actual) | |
| Almaraz I | HE[3]/UE[4]/CSE[5] | PWR | 930 | 2Q81 (Actual) | |
| **Licensed for Startup** | | | | | |
| Almaraz II | HE[3]/UE[4]/CSE[5] | PWR | 930 | 4Q83 (Est.) | |
| Asco I | FESCA[6]/ENHER[7] | PWR | 930 | 4Q83 (Est.) | |
| **Under Construction** | | | | | |
| Cofrentes | HIDROLA[8] | BWR | 975 | 2Q84 (Est.) | 81 |
| Asco II | FECSA[6]/ENHER[7] | PWR | 930 | 4Q84 (Est.) | 86 |
| Valdecaballeros I | HE[3]/CSE[5] | BWR | 975 | Note 12 | 5 |
| Trillo I | UE[4]/ENDESA[9] | PWR | 1032 | Note 12 | 34 |
| Vandellos II | ENHER[7]/FECSA[6] | PWR | 982 | Note 12 | 22 |
| Valdecaballeros II | HE[3]/CSE[5] | BWR | 975 | Indefinite | 2 |
| Lemoniz I | Iberduero | PWR | 900 | Indefinite | 97 |
| Lemoniz II | Iberduero | PWR | 900 | Indefinite | 57 |
| Regodola | FEDENO[10] | PWR | 1000 | Indefinite | 0 |
| Sayago | Iberduero | PWR | 1075 | Indefinite | 0 |
| Trillo II | UE[4]/ENDESA[9] | PWR | 997 | Indefinite | 0 |

[1] Also known as Jose Cabrera.
[2] HIFRENSA—Hispano-Francesa de Energia Nuclear, SA
[3] HE—Hidroelectrica Espanola S.A.
[4] UE—Union Electrica
[5] CSE—Compania Sevillana de Electricidad S.A.
[6] FECSA—Fuerras Electricas de Cataluna S.A.
[7] ENHER—Empresa Nacional Hidroelectrica Ribagorzana
[8] HIDROLA—Hidroelectrica Espanola S.A.
[9] ENDESA—Empresa Nacional de Electrica S.A. (Owned by INI[11]).
[10] Fuerzas Electricas del Noroeste
[11] Institutio Nacional de Industria
[12] One of these three units will be authorized to start up; the other two will be deferred indefinitely.

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Spain's primary energy consumption during the four years from 1979 through 1982 was distributed as indicated in Table 3.

### Table 3

### PATTERN OF PRIMARY ENERGY CONSUMPTION
**(In Percentage)**

| | 1979 | 1980 | 1981 | 1982 |
|---|---|---|---|---|
| Hydro | 11.0 | 11.3 | 11.4 | 11.6 |
| Coal | 15.3 | 18.3 | 22.5 | 27.4 |
| Nuclear | 2.0 | 1.5 | 3.0 | 2.8 |
| Natural Gas | 2.2 | 2.6 | 3.0 | 3.2 |
| Oil | 69.4 | 66.3 | 60.1 | 55.0 |
| TOTAL | 100.0 | 100.0 | 100.0 | 100.0 |

A similar analysis applied to electricity generation for the same period shows the pattern indicated in Table 4.

### Table 4

### SOURCES OF ELECTRICITY GENERATION
**(In Percentage)**

| | 1979 | 1980 | 1981 | 1982 |
|---|---|---|---|---|
| Hydro | 32.8 | 31.4 | 31.3 | 30.3 |
| Coal | 21.5 | 29.1 | 33.5 | 39.3 |
| Nuclear | 6.3 | 4.7 | 8.6 | 7.8 |
| Oil/Gas | 39.4 | 34.8 | 26.6 | 22.6 |
| TOTAL | 100.0 | 100.0 | 100.0 | 100.0 |

## Formation of ENUSA

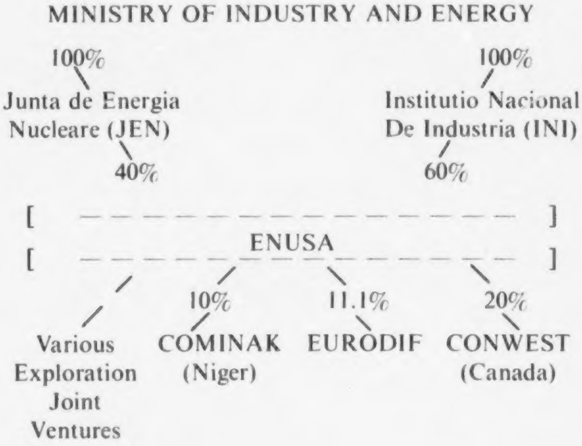
ENUSA (Empresa Nacional de Uranio SA) is a state-owned company formed to conduct three basic activities:

1. Supply of uranium to Spanish utilities;
2. Procurement and supply of enriched uranium;
3. Fuel fabrication, design and management.

Table 5 shows the ownership structure of ENUSA as well as some of its holdings.

### Table 5

### OWNERSHIP STRUCTURE OF ENUSA


MINISTRY OF INDUSTRY AND ENERGY
100%
Junta de Energia Nucleare (JEN)
40%
100%
Institutio Nacional De Industria (INI)
60%
ENUSA
Various Exploration Joint Ventures
10%
COMINAK (Niger)
11.1%
EURODIF
20%
CONWEST (Canada)

## ENUSA's Role in the Nuclear Fuel Cycle

When ENUSA was formed, fuel contracts were still in the hands of individual utilities. Since that time, ENUSA has taken assignment of the contracts from the utilities, and has directly signed new contracts as old ones end. In the mid-1970s, the government charged ENUSA with the acquisition and maintenance of a stockpile amounting to 5 years' forward requirements for the nuclear plants proposed by the nation's first energy plan. However, the expected 5 to 6 year construction time on these units has turned into 10 to 12 years. The 5 year inventory is now closer to 10 years.

It is the implementation of the original ambitious plan in conjunction with the economic slowdown which has created the need for substantial financial resources for the operation of Spain's nuclear program. A rough estimate of the construction delays for the 12 additional units proposed by the first national energy plan (Table 1) amounts to nearly 50,000 megawatt-years. That, in addition to a 5,933 MWe loss due to cancellations and deferrals, has put a further strain on ENUSA. ENUSA is currently caught between the real requirements for the late 1980s and a plan for procurement which is based on a 10-year-old projection.

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## Uranium Concentrates

ENUSA obtains uranium concentrations through domestic production, joint venture operations and long-term contracts. Over the next 5 years, uranium will be supplied to ENUSA in the approximate quantities indicated in Table 6.

**Table 6**

**ENUSA'S URANIUM SUPPLIES**
**(Thousands of Pounds $U_3O_8$ Equivalent)**

| Source | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|
| Domestic Production | 300 | 300 | 300 | 300 | 300 |
| Canada | 500 | 700 | 500 | -0- | -0- |
| Africa | 2,500 | 2,500 | 2,500 | 2,500 | 2,500 |
| TOTAL ANNUAL | 3,300 | 3,500 | 3,300 | 2,800 | 2,800 |

In addition, ENUSA's current inventory contains more than 10 million pounds equivalent $U_3O_8$. A comparison to Nuexco's forecast of annual uranium consumption for the same period, shown in Table 7, indicates that the current state of disequilibrium will worsen measurably over the next five years, absent vigorous corrective measures.

**Table 7**

**ENUSA'S URANIUM SUPPLY-DEMAND BALANCE**
**(Thousands of Pounds $U_3O_8$ Equivalent)**

| | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|
| SUPPLY[1] | 3,300 | 3,500 | 3,300 | 2,800 | 2,800 |
| less | | | | | |
| CONSUMPTION[2] | 4,000 | 1,600 | 2,200 | 2,200 | 2,200 |
| equals | | | | | |
| NET INVENTORY INCREASE/(DECREASE) | (700) | 1,900 | 1,100 | 600 | 600 |
| plus | | | | | |
| BEGINNING INVENTORY | 10,000 | 9,300 | 11,200 | 12,300 | 12,900 |
| equals | | | | | |
| ENDING INVENTORY | 9,300 | 11,200 | 12,300 | 12,900 | 13,500 |

[1] This Report, Table 6
[2] Nuexco forecast

## Conversion Services

ENUSA had originally planned its own conversion facility. After the necessary studies were completed, however, the nuclear program had slowed sufficiently to postpone the project indefinitely. ENUSA has long-term contracts with several non-US convertors, yielding a current excess of over 4 million pounds U in conversion services.

## Enrichment Services

Table 8 shows approximate amounts of ENUSA's current obligations to purchase enrichment services.

**Table 8**

**ENUSA ENRICHMENT OBLIGATIONS**
**(Thousands of SWUs)**

| | Year of Delivery | | | | |
|---|---|---|---|---|---|
| Source | 1983 | 1984 | 1985 | 1986 | 1987 |
| DOE | 100 | 500 | 600 | 500 | 600 |
| EURODIF | 600 | 700 | 1,000 | 1,000 | 1,000 |
| USSR | 400 | 400 | 400 | 500 | 500 |
| TOTAL ANNUAL | 1,100 | 1,600 | 2,000 | 2,000 | 2,100 |

Table 9 presents a comparison of annual supply to maximum annual requirements, indicating a cumulative surplus of one million SWUs for the period 1983-1987.

**Table 9**

**ENUSA'S ENRICHMENT BALANCE**
**(Millions of SWUs)**

| | Year of Delivery | | | | |
|---|---|---|---|---|---|
| | 1983 | 1984 | 1985 | 1986 | 1987 |
| SUPPLY | 1.1 | 1.6 | 2.0 | 2.0 | 2.1 |
| less | | | | | |
| MAX. REQ'T | 1.5 | 1.0 | 1.5 | 1.8 | 1.9 |
| equals | | | | | |
| ANNUAL SURPLUS/(DEFICIT | (0.4) | 0.5 | 0.5 | 0.2 | 0.2 |
| plus | | | | | |
| BEGINNING INVENTORY | 6.2 | 5.8 | 6.3 | 6.8 | 7.0 |
| equals | | | | | |
| ENDING INVENTORY | 5.8 | 6.3 | 6.8 | 7.0 | 7.2 |

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Thus, by the end of 1987, ENUSA will have added another one million SWUs to inventory, on top of the 6.2 million SWUs already held in inventory as of the beginning of 1983. This surplus can of course be reduced by sales of SWUs or renegotiations with SWU suppliers.

### Fuel Fabrication

The Juzbado plant located between Salamanca and the Portuguese border some 150 miles northwest of Madrid is completing the installation of equipment to produce both BWR and PWR fuel elements under General Electric and Westinghouse licenses, respectively. The various process lines are expected to complete testing during the third quarter of 1983. Commercial production is scheduled to begin by the end of 1983 or early 1984, starting with reloads for the Garona and Zorita plants. The projected production is 200 tons per year initially to meet current requirements, although it could double production in response to future demands.

### Spent Fuel

Spent fuel from operating reactors has heretofore been sent to France for the Vandellos I plant and to the United Kingdom for the Garona and Zorita plants. By 1990, the total volume of spent fuel will amount to approximately 1,600 tons. Therefore, short-term needs can be met adequately by means of on-site pool storage (at the individual nuclear units). For the longer term, ENUSA has under study the design and construction of separate centralized storage facilities.

### Radwaste Storage

JEN is in charge of Spain's radioactive waste storage programs. Low and medium radioactivity wastes are estimated to represent some 30,000 cubic meters by 1990. JEN has under study the application of the two most common methods, namely burial at sea and burial in a geologically stable environment, such as a salt dome. JEN is already using both methods for the waste coming from small-scale activities such as research medicine, radioisotopes, etc.

### Conclusion

Spain's situation is neither particularly unique nor the result of poor management. On the contrary, sound decisions were made in the 1970s based on specific goals established by the national energy plan. But, as in numerous other countries, the change in one assumption, such as the growth rate of electricity demand, can reduce an excellent program ideal to a cumbersome and costly reality. Faced with uranium inventories of more than 10 million pounds equivalent $U_3O_8$ and enrichment services inventories of more than 6 million SWUs, and with both inventories scheduled to increase over the next five years, ENUSA can be expected to renegotiate as many of those commitments as possible, and to the maximum feasible extent.

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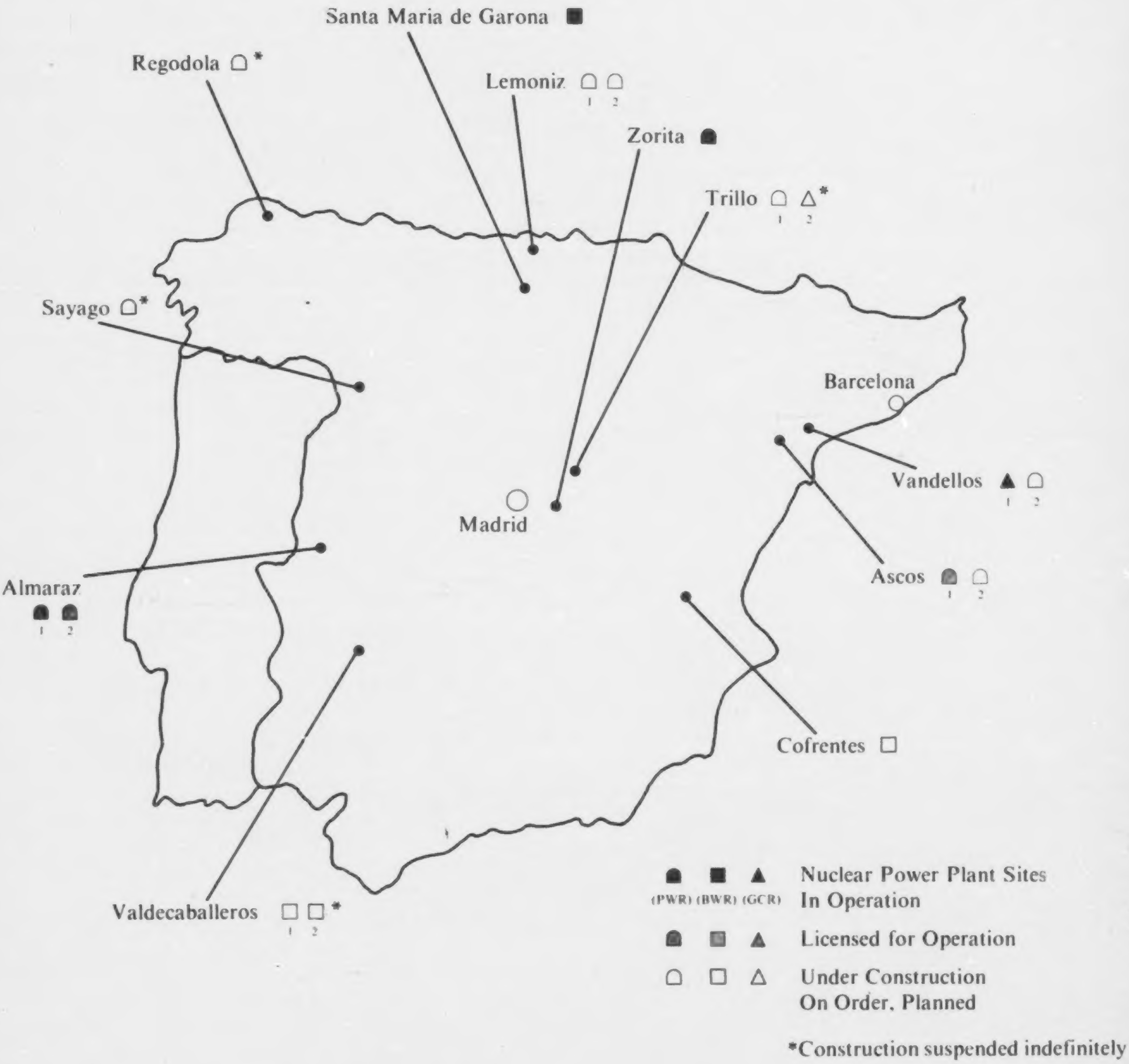
Santa Maria de Garona ■
Regodola ☖*
Lemoniz ☖ ☖ 1 2
Zorita ☗
Trillo ☖ △* 1 2
Sayago ☖*
Barcelona
Vandellos ▲ ☖ 1 2
Madrid
Ascos ☗ ☖ 1 2
Almaraz ☗ ☗ 1 2
Cofrentes □
Valdecaballeros □ □* 1 2
☗ ■ ▲ (PWR) (BWR) (GCR) Nuclear Power Plant Sites In Operation
☗ ■ ▲ Licensed for Operation
☖ □ △ Under Construction On Order, Planned
*Construction suspended indefinitely

**Figure 1**

**DISTRIBUTION OF POWER PLANTS IN SPAIN**

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## GREENLAND: THE KVANEFJELD URANIUM DEPOSIT

### Introduction

The Greenland Geological Survey (GGU) discovered in 1956 a large low-grade uranium deposit near the village of Narssaq in southern Greenland. Named for its geographic location on the Kvanefjeld Plateau, the deposit was discovered during the second year of uranium exploration sponsored by the Danish Atomic Energy Commission (AEK). The deposit contains an estimated 62 million tonnes of ore averaging 408 parts per million (ppm) $U_3O_8$, equivalent to approximately 55.7 million pounds $U_3O_8$. Figure 2 shows the location of the deposit in South Greenland.

Uranium mineralization occurs in association with alkaline rocks of the Ilimaussaq igneous complex. Radioactivity was noted by Danish scientists in the intrusive rocks as early as 1881. Thorium was identified as the radioactive source material in the mineral steenstrupine, a complex silicophosphate of thorium, uranium, rare earths and other metals. Radioactive occurrences in the area of the Kvanefjeld Plateau were again noted in geologic reports written by Danish geologists in 1905 and 1912.

When the initial uranium exploration program began in the summer of 1955, the Ilimaussaq complex was given priority as a favorable exploration target. The GGU assigned military personnel, under the direction of a geologic consultant, to conduct a ground radiometric survey over a designated area of the plateau. The initial results were inconclusive, but encouraging enough to continue the surveys, complimented by an airborne scintillometer survey, during the 1956 summer field season.

Radiometric surveys had been completed over most of the intrusive by the end of the second year. It was quickly concluded that the most important radioactive occurrences were associated with a sequence of flow and intruded rocks on the Kvanefjeld Plateau. The general area of radioactivity was outlined and the surface limits of important mineralization determined by detailed radiometric studies and chemical assays of rock samples. AEK officials considered the discovery to be of geologic and economic significance, and project evaluation studies have continued over the years. The main thrust of late has been devoted to the development of favorable extractive technology.

### Project Evaluation

A detailed radiometric survey was made on a 50 meter grid over the most promising area designated as the mine area. Closer detailing was carried out on 5 meter grids to define the areas of highest radioactivity. The first core drilling program occurred in 1958, when 30 holes were drilled on locations of high favorability in the mine area. Average drilled depth was about 100 meters; the deepest holes were 180 meters. Each hole was terminated when the uranium content of the core decreased to less than 235 ppm $U_3O_8$. (All holes drilled on the property were logged with a gamma spectral system. The probe unit consisted of a 3 inch NaI detector and a Scintrex GAD-6 gamma spectrometer.) Six holes were drilled on radioactive anomalies outside the mine area in anticipation of making a new discovery; however, only trace mineralization was encountered Drill footage totaled 3,728 meters in 1958.

Drilling results of the 30 holes indicated an irregular distribution of mineralization primarily within the upper 30 meters. Frequent changes in lithology also were recorded. The highest grade mineralization was noted to occur in a layered sequence of lujavrite, a medium to coarse-grained nepheline syenite, pegmatitic lujavrite, and altered lava and gabbro. The inconsistencies in radioactivity and lithology between holes made interpretation extremely difficult. It was concluded that additional drilling would be required to determine the full potential of the deposit.

Evaluation programs were curtailed during the period 1959 to 1961. They resumed in 1962 with a limited core drilling program. Seven holes were drilled to a depth of 200 meters on radioactive anomalies outside the Kvanefjeld Plateau. The results were negative.

Geologic mapping of the Ilimaussaq intrusion also was started in 1962. The project was not completed until 1967. All geologic studies were limited to the Kvanefjeld Plateau following the mapping. Almost the entire Ilimaussaq intrusion, outside the Kvanefjeld plateau, consists of unfavorable geology for uranium mineralization. Detailed mapping of the mine area was completed to permit closer coordination of drilling with geologic and structural interpretation.

Two holes drilled previously in the mine area were deepened to 200 meters during the 1962 program. The results were again inconclusive. Mineralization proved to be low-grade and highly irregular in occurrence. The main activity for the 1962 season was the mining of 180 tonnes of ore from an adit driven 20 meters into the

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upper portion of the orebody. The mined material consisted of pegmatitic lujavrite and altered lava. The ore averaged 740 ppm $U_3O_8$. It was shipped to Riso National Laboratory, in Roskilde, Denmark for beneficiation tests, even though the $U_3O_8$ percentage was well above the average grade of the ore deposit.

A total of 1621 meters of drilling was completed during the 1969 field season. One hole was drilled to a depth of 450 meters in the mine area; however, results were again inconclusive. Two holes were drilled on an outcrop of fine-grained lujavrite to the north of the mine area. Radioactivity averaging 412 ppm $U_3O_8$ was encountered to the drilled depth of 200 meters. It was the first important mineralization to be found outside the mine area. Uranium resources for the mine area and the two holes drilled in the northern area were estimated at about 6100 tonnes $U_3O_8$, at an average grade of 365 ppm $U_3O_8$.

During the period 1970 through 1976, comprehensive metallurgical testing and project feasibility studies were carried out. The first regional environmental study for mining and ore processing was initiated. All study results, including technical and economic consideration, indicated project development had favorable possibilities, given increasing ore reserves to facilitate large-volume mining. A decision was made to undertake yet a fourth drilling program.

The northern area was selected for core drilling in 1977. Twenty-one holes were drilled to a depth of 200 meters for a total of 4,256 meters. Hole spacing was 145 meters. Drilling results proved to be extremely important to the future of the project. It was determined that the ore in the northern area is an extension of that in the mine area. An ore reserve study of both areas indicated the presence of approximately 62 million tonnes of ore averaging 0.90 pounds $U_3O_8$ per tonne. The total $U_3O_8$ estimate for the Kvanefjeld deposit is 55.7 million pounds. The cut-off grade is 0.60 pounds $U_3O_8$ per tonne.

The long period of property evaluation was concluded in 1980 with the completion of a 980 meter long exploration drift driven through the mine area and into the northern area. Approximately 4,700 tonnes of ore were mined for additional metallurgical work. Almost 1500 tonnes were shipped to Riso Laboratory for further testing of uranium extraction by a new pressure leaching process. The remaining 3200 tonnes are stockpiled at the mine site and will be shipped to Riso Laboratory as needed to complete metallurgical studies. Figure 3 is a map showing the limit of drilling, the direction and extent of the exploration drift, and the surface geology.

## Geology

The Ilimaussaq intrusion is considered one of the youngest intrusions associated with the Gardar igneous province that covers much of South Greenland. The Gardar complex is made up of several generations of major intrusions and basaltic lava flows. The Gardar has been age-dated at 1,100 to 1,400 million years. The Ilimaussaq intruded Gardar lavas and related rocks about 1,000 to 1,050 million years ago.

The Ilimaussaq intrusion comprises a series of alkaline syenites and granites. The important uranium-bearing series is lujavrite, which intruded a layered sequence of Gardar syenites, lavas and gabbros in the Kvanefjeld area. Several different types of lujavrites have been described. Medium to coarse-grained rock has the highest uranium content, followed by fine to medium-grained rock. Combined, the two rock types make up most of the Kvanefjeld uranium deposit. Altered and deformed lavas and gabbros make up the remaining portion of mineralized rock (see Figure 3).

Late-stage lujavrites intruded primarily along northwest-southeast trending zones of shearing and brecciation associated with structural doming and collapse features found in the Kvanefjeld area. The main ore mineral steenstrupine occurs along the zones of weakenss in fractures and veins, and as disseminations throughout lujavrites, lavas and gabbros, forming the outer crust of the dome-like structure. Moderate to intense alteration of different rocks has occurred adjacent to structural patterns. Mineralization is often more abundant along such zones. However, the degree of alteration can adversely affect the refractory qualities of the mineral steenstrupine, and the percentage of uranium recovery from altered ores is often less than desired.

## Mining

Tentative mining plans call for open pit mining of the mine area and most of the northern area. The deeper ore in the northern area may be mined by underground methods. Figure 3 shows the outline of core drilling in the two areas. The outline represents an approximate surface limit of two planned open pits which could develop into one as mining progresses. Figure 4 is a photo looking southwest across the mine area and the south end of the northern area.

The first mining will begin in the mine area. Plans may include the simultaneous development of a portion of the

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deeper ore in the northern area. The purpose would be to install underground crushing and ore preparation facilities as protection against adverse winter weather conditions. An underground transportation system, probably a conveyor belt arrangement, would carry the crushed ore about four kilometers to the planned mill site on the broad plain at the foot of Ilimaussaq Mountain. Figure 5 is a photo looking northeast to Ilimaussaq Mountain. The processing plant will be located on the gentle slopes about where the drainage cuts the center of the photo.

An annual production schedule of four to six million pounds $U_3O_8$ is being considered. The $U_3O_8$ concentrate would be shipped out on boats which would be loaded at special dock facilities to be constructed on the fjord immediately north of the Kvanefjeld Plateau. Construction of the mine and mill complex would require two to three years. Final development planning is included in the current project evaluation study.

**Ore Beneficiation**

The AEK recognized early in the Kvanefjeld project that economic success would depend on a favorable beneficiation process. Metallurgical studies began on the first drill cores recovered in 1958. The task of ore beneficiation was assigned to the chemistry department of Riso Laboratory at that time. It was determined that conventional acid and carbonate leaching techniques were completely unsatisfactory recovery methods for the refractory ores of the Kvanefjeld deposit. An alternate recovery method was developed.

The general beneficiation process selected for the ore was sulphating roasting. A pilot plant study involved the following procedures:

1. The ore is crushed to a minus 100 mesh to liberate the uranium-bearing steenstrupine grains.
2. It is pelletized and roasted with $SO_3$ gas at 700°C, forming water soluble uranium salt.
3. The uranium is leached out by repeated washing with water.
4. Recovery of 40% to 70% of contained $U_3O_8$ is by conventional solvent extraction.

Associated minerals of zirconium, zinc, niobium and rare earths are recoverable through variations of the final recovery step.

During the years of metallurgical testing by sulphating roasting, only marginal success was achieved. The uranium recovery rate was consistently below economic levels. The recovery pilot system was changed in 1978 to a newly developed carbonate pressure leaching process. In this process, the crushed ore enters a horizontal pipe autoclave as a slurry. It is heated to the reaction temperature of 250° C for about 17 minutes as it is being forced through the autoclave. Under the influence of carbonate and oxygen, the uranium minerals are decomposed and the uranium is retained in solution. The slurry travels direct from the autoclave to filtration where the leach liquor is separated from the residue. The uranium is precipitated from the carbonate solution by reduction with hydrogen. Sodium fluoride forms as a water soluble mineral during the process. The by-product recovery of artificial fluorite ($CaF_2$) would be an important contribution to project economics.

Uranium recovery has increased to a more consistent level of 70 percent to 90 percent with the carbonate leaching process and potential economics of the project have greatly improved. Current feasibility studies include consideration for total development of the ore deposit. The potential recovery of by-product minerals offers additional economic incentive to the project. The final decision to move ahead with the project will be made by the Danish government. The decision will no doubt be dependent on a favorable projection of future market price and demand for uranium and the by-product minerals.

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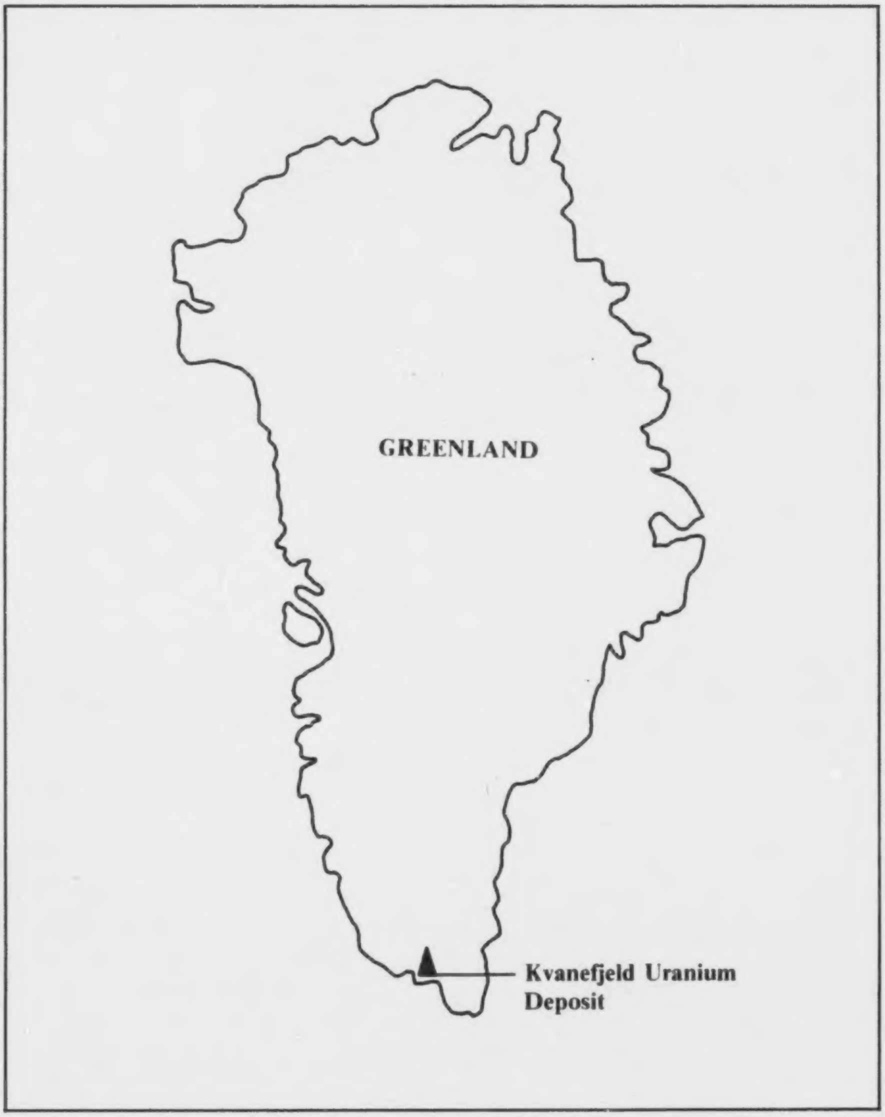
GREENLAND
Kvanefjeld Uranium Deposit

**Figure 2**

**Location map of the Kvanefjeld uranium deposit in Southern Greenland**

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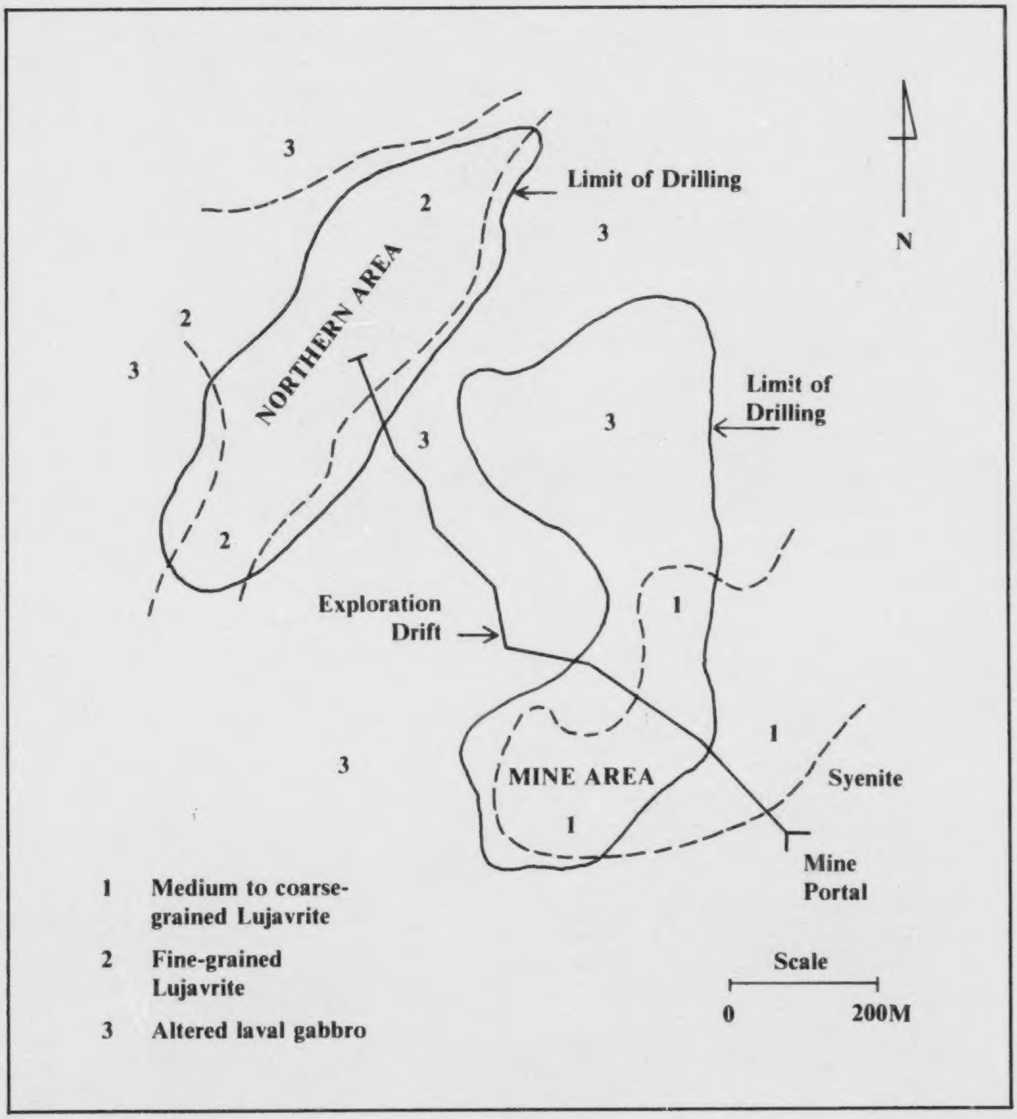
3
2
Limit of Drilling
3
N
NORTHERN AREA
2
3
3
3
Limit of Drilling
2
Exploration Drift
1
1
3
Syenite
MINE AREA
1
Mine Portal
1 Medium to coarse-grained Lujavrite
2 Fine-grained Lujavrite
3 Altered laval gabbro
Scale
0
200M

Figure 3

**Map of the Kvanefjeld uranium deposit showing mineralized host rocks and limit of core drilling which also represents approximate area considered for open pit mining. Not all of drilled area is ore. The direction and extent of the exploration drift is shown also.**

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**Figure 4**

**Looking southwest over the mine area and the south end of the northern area. The first mining will be limited to the area of low relief in the central and lower right portion of the picture.**

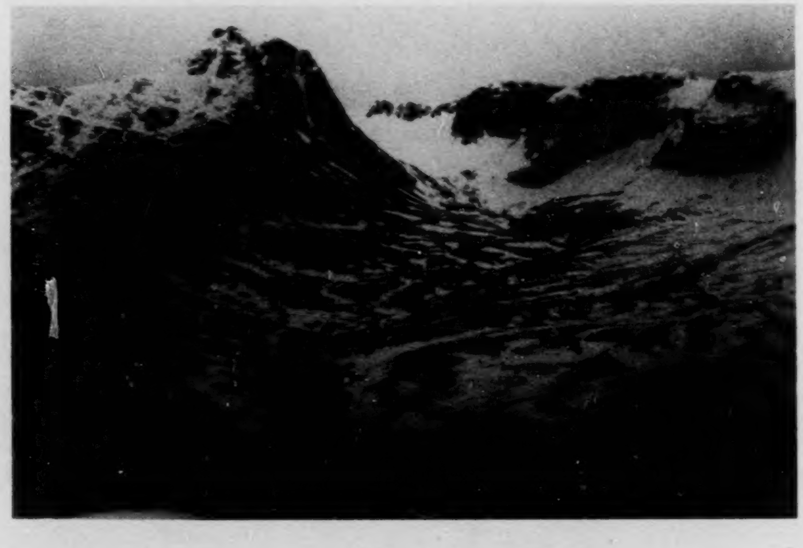

**Figure 5**

**The tentative location for a processing plant is indicated to the left of the drainage.**

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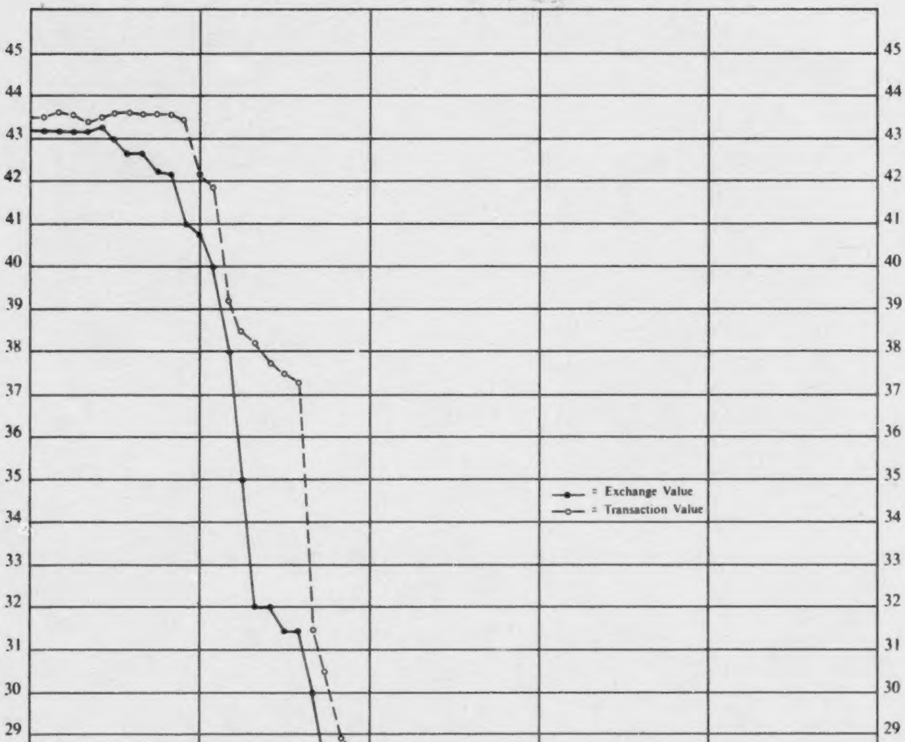
## EXCHANGE AND TRANSACTION VALUES SINCE JANUARY 1979

Determined as of the last day of the month indicated



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*HISTORICAL MARKET DATA*

## HISTORICAL EXCHANGE VALUES

Determined as of the last day of the month indicated (US Dollars/lb. $U_3O_8$)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1968 | — | — | — | — | — | — | — | 6.35 | 6.35 | 6.40 | 6.45 | 6.50 |
| 1969 | — | 6.35 | 6.10 | 6.10 | 6.25 | 6.25 | 6.20 | 6.20 | 6.15 | 6.15 | 6.15 | 6.20 |
| 1970 | 6.30 | 6.30 | 6.30 | 6.30 | 6.30 | 6.30 | 6.30 | 6.20 | 6.15 | 6.15 | 6.15 | 6.15 |
| 1971 | 6.20 | 6.20 | 6.20 | 6.20 | 6.15 | 6.05 | 6.00 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 |
| 1972 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 |
| 1973 | 5.95 | 6.00 | 6.10 | 6.20 | 6.45 | 6.50 | 6.50 | 6.50 | 6.50 | 6.50 | 6.75 | 7.00 |
| 1974 | 7.70 | 7.90 | 8.00 | 9.00 | 9.50 | 10.50 | 11.50 | 12.00 | 12.50 | 14.00 | 14.75 | 15.00 |
| 1975 | 16.00 | 16.00 | 18.00 | 20.00 | 21.00 | 23.00 | 24.70 | 26.00 | 26.00 | 28.50 | 30.00 | 35.00 |
| 1976 | 35.20 | 37.00 | 39.25 | 40.00 | 40.00 | 40.00 | 40.00 | 40.40 | 41.00 | 41.00 | 41.50 | 41.00 |
| 1977 | 41.35 | 41.50 | 41.60 | 41.60 | 42.00 | 42.25 | 42.25 | 42.25 | 42.40 | 42.75 | 43.20 | 43.20 |
| 1978 | 42.90 | 43.25 | 43.25 | 43.25 | 43.40 | 43.40 | 43.40 | 43.10 | 43.25 | 43.00 | 43.25 | 43.25 |
| 1979 | 43.25 | 43.25 | 43.25 | 43.25 | 43.25 | 43.00 | 42.70 | 42.70 | 42.20 | 42.20 | 41.00 | 40.75 |
| 1980 | 40.00 | 38.00 | 35.00 | 32.00 | 32.00 | 31.50 | 31.50 | 30.00 | 28.50 | 28.00 | 28.00 | 27.00 |
| 1981 | 25.00 | 25.00 | 25.00 | 25.00 | 25.00 | 24.25 | 23.50 | 23.50 | 23.50 | 23.50 | 23.50 | 23.50 |
| 1982 | 23.00 | 23.00 | 22.50 | 20.75 | 20.50 | 19.25 | 18.25 | 17.00 | 17.00 | 17.50 | 19.75 | 20.25 |
| 1983 | 21.50 | 21.75 | 22.25 | 23.25 | 23.50 | 23.50 | **24.00** | | | | | |

## HISTORICAL TRANSACTION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. $U_3O_8$)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1976 | — | — | — | — | 39.60 | 39.70 | 39.70 | 40.40 | 40.30 | 40.60 | 40.70 | 40.70 |
| 1977 | 41.30 | 41.30 | 41.40 | 41.50 | 42.80 | 42.90 | 43.00 | 42.60 | 42.50 | 42.80 | 42.90 | 42.90 |
| 1978 | 43.10 | 43.30 | 43.70 | 43.60 | 43.60 | 43.20 | 43.30 | 43.40 | 43.40 | 43.60 | 43.40 | 43.70 |
| 1979 | 43.60 | 43.80 | 43.70 | 43.40 | 43.60 | 43.70 | 43.70 | 43.60 | 43.60 | 43.60 | 43.50 | 42.30 |
| 1980 | 42.00 | 39.30 | 38.60 | 38.40 | 37.90 | 37.60 | 37.30 | 31.60 | 30.60 | 29.00 | 28.70 | 27.70 |
| 1981 | 27.20 | 27.20 | 27.00 | 25.70 | 25.70 | 24.50 | 24.40 | 24.30 | 23.90 | 24.10 | 24.10 | 24.00 |
| 1982 | 24.00 | 23.70 | 23.40 | 22.60 | 22.70 | 21.50 | 20.30 | 19.10 | 17.30 | 17.00 | 17.55 | 18.80 |
| 1983 | 19.35 | 20.00 | 21.35 | 21.40 | 22.35 | 22.45 | **23.50** | | | | | |

## HISTORICAL CONVERSION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. $U_6$)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1981 | 1.20 | 1.20 | 1.20 | 1.40 | 1.15 | 1.15 | 1.15 | 1.10 | 1.10 | 1.10 | 1.20 | 1.20 |
| 1982 | 1.20 | 1.20 | 1.20 | 1.20 | 1.00 | 1.00 | 1.00 | 0.90 | 1.10 | 1.60 | 1.45 | 1.45 |
| 1983 | 1.20 | 1.40 | 1.40 | 1.20 | 1.20 | 1.20 | **1.10** | | | | | |

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## AUSTRALIA

| | Price Index of Materials Used in Manufacturing Industry—All Groups (Year 1968-69 = 100.0)[1] | Award Rates of Pay Indexes Australia—Adult Males In Mining Wage Earners, Weekly Rates (Year 1976 = 100.0)[2] |
|---|---|---|
| Annual Avg. 1972[3] | 105.6 | 71.26 |
| Annual Avg. 1973[3] | 124.4 | 78.96 |
| Annual Avg. 1974[3] | 141.9 | 108.07 |
| Annual Avg. 1975[3] | 150.4 | 132.55 |
| Annual Avg. 1976[3] | 168.4 | 160.93 |
| Annual Avg. 1977[3] | 192.0 | 179.03 |
| Annual Avg. 1978[3] | 198.5 | 190.04 |
| Annual Avg. 1979 | 248.8 | 196.34 |
| Annual Avg. 1980 | 321.8 | 218.00 |
| Annual Avg. 1981 | 355.3 | 237.34 |
| Annual Avg. 1982 | 367.9 | — |
| Feb 1982 | 356.7 | 171.1 |
| Mar 1982 | 360.3 | 171.4 |
| Apr 1982 | 367.7 | 171.4 |
| May 1982 | 367.6 | 171.9 |
| Jun 1982 | 367.8 | 173.2 |
| Jul 1982 | 370.0R | 177.2 |
| Aug 1982 | 372.4R | 178.2R |
| Sep 1982 | 374.9R | 178.4R |
| Oct 1982 | 378.1R | 178.4R |
| Nov 1982 | 375.4R | 178.5R |
| Dec 1982 | 374.6R | 179.5R |
| Jan 1983 | 386.6R | 179.3R |
| Feb 1983 | 388.3R | 179.1R |
| Mar 1983 | 398.4R | 179.0R |
| Apr 1983 | 409.7 | 179.4 |

P = Preliminary    R = Revised since last month

[1] Australian Bureau of Statistics, Canberra: "Price Index of Materials Used in Manufacturing Industry" (Catalogue No. 6411.0), Table 3.

[2] Australian Bureau of Statistics, Canberra: "Award Rates of Pay Indexes, Australia" (Catalogue No. 6312.0), Table 8. Figures are being converted to an Index number. As the data are converted, the new index numbers will be inserted. Figures for the latest fourteen months shown are subject to revision.

[3] Monthly data for 1970 through 1978 appear on pages 4.7 and 4.8 of Nuexco Report 138.

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## *GOVERNMENT STATISTICS*

### CANADA

| | Industry Selling Price Index: Manufacturing (D 500000)[1] [2] (1971 = 100.0) | Wage-earner Data: Average Hourly Earnings (C$)[4] [5] | | | | |
|---|---|---|---|---|---|---|
| | | Metal Mining, including Milling (SIC 050-099)[3] | (SIC 296) | Primary Metal Industries, non-ferrous (SIC 296-298)[6] | (SIC 298) | Chemicals and Chemical Products (SIC 372-379)[7] |
| Annual Avg. 1979 | 217.9 | 9.66 | — | 7.35 | — | 7.67 |
| Annual Avg. 1980 | 247.2 | 10.80 | — | 8.05 | — | 8.50 |
| Annual Avg. 1981 | 288.7 | 12.23 | — | 9.03 | — | 9.53 |
| Annual Avg. 1982 | 288.8 | 13.92 | — | 9.98 | — | 10.63 |
| Apr 1982 | 287.7 | 13.81 | — | 9.79 | — | 10.48 |
| May 1982 | 288.8 | 13.86 | — | 9.88 | — | 10.62 |
| Jun 1982 | 289.7 | 13.83 | — | 9.92 | — | 10.69 |
| Jul 1982 | 290.3 | 14.02 | — | 10.05 | — | 10.73 |
| Aug 1982 | 290.3 | 14.23 | — | 10.03 | — | 10.80 |
| Sep 1982 | 292.4 | 14.01 | — | 10.18 | — | 10.73 |
| Oct 1982 | 292.1 | 13.89 | — | 10.18 | — | 10.86 |
| Nov 1982 | 291.3 | 14.28 | — | 10.43 | — | 10.90 |
| Dec 1982 | 292.3 | 14.32 | — | 10.55 | — | 11.06 |
| Jan 1983 | 292.7 | 14.35 | — | 10.72 | — | 11.06 |
| Feb 1983 | 293.5 | 14.28R | — | 10.74R | — | 11.06R |
| Mar 1983 | 295.2 | 14.48R | — | 10.93R | — | 11.21P |
| Apr 1983 | 297.1R | 13.69P | 11.55P | — | 9.74P | 10.75P |
| May 1983 | 298.4R | — | — | — | — | — |
| Jun 1983 | 299.9 | — | — | — | — | — |

P = Preliminary    R = Revised since last month

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[1] Statistics Canada, Prices Division, Ottawa: "Industry Price Indexes" (Catalogue 62-011), Table 1. Indexes for the most recent six months shown are subject to revision.

[2] Monthly data for 1973 through 1978 appear on page 4.10 of Nuexco Report 138.

[3] The wage earner series in Nuexco reports prior to March 1983 was Metals (SIC 050-059).

[4] Statistics Canada, Labour Division, Employment and Payrolls Section, Ottawa: "Employment, Earnings and Hours" (Catalogue 72-002), Table 2.

[5] Monthly data for 1977 and 1978 appear on page 4.11 of Nuexco Report 138.

[6] Beginning with the April 1983 figure, Primary Metal Industries, non-ferrous will be split into SIC 296 and SIC 298.

[7] Chemical and Chemical Products prior to April 1983 was SIC 370-379. The new series is from a new survey which includes all companies and is based on a 1970 classification. The old survey included companies of 20 employees or more.

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## REPUBLIC OF SOUTH AFRICA

| | Average Declared Working Costs per Metric Ton of Gold Ore Milled (Rand)[1] | Consumer Price Index[2] (1975 = 100, except where otherwise indicated) | Producer[5] Price Index All Groups (1975 = 100) | Total Employment in Mining and Quarrying (Code 35)[7] | Total Salaries and Wages in Mining and Quarrying (1,000 Rand) (Code 40)[7] |
|---|---|---|---|---|---|
| Annual Avg. 1972[3] | 8.79 | 113.3[4] | 63.9 | 623,067 | 443,933 |
| Annual Avg. 1973[3] | 10.51 | 124.1[4] | 72.3 | 684,743 | 572,133 |
| Annual Avg. 1974[3] | 13.18 | 138.5[4] | 85.3 | 674,140 | 761,596 |
| Annual Avg. 1975[3] | 16.71 | 157.2[4] | 100.0 | 639,473 | 1,003,617 |
| Annual Avg. 1976[3] | 19.30 | 174.7[4] | 115.1 | 671,240 | 1,212,983 |
| Annual Avg. 1977[3] [6] | 23.87 | 194.4[4] | 130.0 | 712,006 | 1,420,670 |
| Annual Avg. 1978[3] [6] | 27.14 | 137.2 | 142.7 | 664,571 | 1,537,169 |
| Annual Avg. 1979[3] [6] | 30.18 | 155.3 | 164.5 | 692,209 | 1,830,632 |
| Annual Avg. 1980[6] | 35.53 | 176.7 | 192.1 | 714,379 | 2,279,615 |
| Annual Avg. 1981 | 41.89 | 206.5 | 218.3 | 728,506 | 2,820,505 |
| Annual Avg. 1982 | 47.25 | 233.5 | 248.7 | 707,552 | 3,246,071 |
| Jan 1982 | — | 217.6 | 233.1 | 700,375 | 257,173 |
| Feb 1982 | — | 220.2 | 236.8 | 705,992 | 250,191 |
| Mar 1982 | 45.49 | 225.2 | 237.4 | 725,700 | 262,210 |
| Apr 1982 | — | 228.9 | 241.9 | 707,502 | 252,562 |
| May 1982 | — | 230.3 | 244.8 | 715,162 | 258,770 |
| Jun 1982 | 45.77 | 232.1 | 246.7 | 707,552 | 261,361 |
| Jul 1982 | — | 234.1 | 249.4 | 702,141 | 283,248 |
| Aug 1982 | — | 236.8 | 253.4 | 705,562 | 276,730 |
| Sep 1982 | 48.04 | 241.0 | 255.0 | 704,344 | 282,782 |
| Oct 1982 | — | 243.9 | 260.1 | 701,316 | 285,328 |
| Nov 1982 | — | 245.4 | 262.5 | 707,966 | 287,699 |
| Dec 1982 | 49.62 | 246.2 | 263.0 | 683,982 | 288,019 |
| Jan 1983 | — | 249.0 | 264.9 | 688,030 | 289,075 |
| Feb 1983 | — | 253.1 | 267.4 | 697,089 | 281,413 |
| Mar 1983 | 50.35 | 255.9 | 269.1 | 695,976R | 290,586R |
| Apr 1983 | — | 257.8 | 270.9 | 697,158 | 286,708 |
| May 1983 | — | 259.7 | 274.3 | — | — |
| Jun 1983 | — | 260.8 | — | — | — |

---

[1] Chamber of Mines of South Africa, Johannesburg; "Analysis of Working Results," published quarterly. The tonnage-weight index of average working costs per metric ton of gold ore milled for 1983 is as follows. (Base: March quarter 1982 = 100). See Nuexco report #178 page 24 for the tonnage-weighted index for 1982. Description and calculation of the index is on page 16 of Nuexco report #178.

| | |
|---|---|
| 1983: January-March | 111.2 |

[2] Republic of South Africa Department of Statistics, Pretoria; "Government Gazette: Consumer Price Index for Urban Areas."

[3] Historical data for the Average Declared Working Costs and Consumer Price Index 1970-1979 appear on page 4.9 of Nuexco Report 140.

[4] April 1970 = 100.00.

[5] Previously known as the WHOLESALE PRICE INDEX, now the PRODUCER PRICE INDEX. The computation remains the same.

[6] Historical data for Codes 35 and 40 1977-1980 appear on page 28 of Nuexco Report 157.

[7] Bulletin of Statistics, Department of Statistics, Pretoria.

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## *GOVERNMENT STATISTICS*

### UNITED STATES

| | Producer Price Index— Industrial Commodities (1967 = 100)[1] | Producer Price Index— All Commodities (1967 = 100)[1] | Consumer Price Index (1967 = 100)[2] | GNP Implicit Price Deflator (1972 = 100)[3] | Gross Average Hourly Earnings of Production or Non-supervisory Workers (US$)[4] | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Metal Mining (SIC 10) | Primary Non-ferrous Metals (SIC 333) | Chemicals and Allied Products (SIC 28) | Electric and Electronic Equipment (SIC 36) |
| Annual Avg. 1972[5] | 117.9 | 119.1 | 125.3 | 100.00 | 4.56 | 4.59 | 4.26 | 3.71 |
| Annual Avg. 1973[5] | 125.9 | 134.7 | 133.1 | 105.75 | 4.84 | 4.98 | 4.51 | 3.91 |
| Annual Avg. 1974[5] | 153.8 | 160.1 | 147.7 | 115.08 | 5.44 | 5.63 | 4.88 | 4.21 |
| Annual Avg. 1975[5] | 171.5 | 174.9 | 161.2 | 125.79 | 6.13 | 6.24 | 5.39 | 4.64 |
| Annual Avg. 1976[5] | 182.4 | 183.0 | 170.5 | 132.34 | 6.76 | 6.87 | 5.91 | 4.96 |
| Annual Avg. 1977[5] | 195.1 | 194.2 | 181.5 | 140.05 | 7.28 | 7.67 | 6.43 | 5.39 |
| Annual Avg. 1978[5] | 209.4 | 209.3 | 195.4 | 150.42 | 8.23 | 8.56 | 7.02 | 5.82 |
| Annual Avg. 1979[5] | 236.5 | 235.6 | 217.4 | 163.42 | 9.27 | 9.50 | 7.60 | 6.32 |
| Annual Avg. 1980[5] | 274.8 | 268.8 | 246.8 | 178.64 | 10.26 | 10.63 | 8.30 | 6.94 |
| Annual Avg. 1981 | 304.1 | 293.4 | 272.4 | 195.51 | 11.55 | 11.98 | 9.12 | 7.62 |
| Annual Avg. 1982 | 312.3 | 299.3 | 289.1 | 207.15 | 12.33 | 12.94 | 9.96 | 8.21 |
| Jun 1982 | 310.6 | 299.3 | 290.6 | 205.98 | 12.28 | 12.95 | 9.94 | 8.14 |
| Jul 1982 | 312.8 | 300.4 | 292.2 | — | 12.23 | 12.94 | 10.00 | 8.23 |
| Aug 1982 | 313.2 | 300.2 | 292.8 | — | 12.29 | 13.01 | 10.01 | 8.30 |
| Sep 1982 | 312.7 | 299.3 | 293.3 | 208.51 | 12.53 | 13.51 | 10.19 | 8.37 |
| Oct 1982 | 314.3 | 299.8 | 294.1 | — | 12.51 | 13.26 | 10.22 | 8.41 |
| Nov 1982 | 315.0 | 300.3 | 293.6 | — | 12.53 | 13.22 | 10.26 | 8.45 |
| Dec 1982 | 315.2 | 300.7 | 292.4 | 210.42 | 12.53 | 13.05 | 10.32 | 8.51 |
| Jan 1983 | 313.9 | 299.9 | 293.1 | — | 12.63 | 13.33 | 10.34 | 8.53 |
| Feb 1983 | 313.9R | 300.9R | 293.2 | — | 12.66 | 13.29 | 10.41 | 8.56 |
| Mar 1983 | 313.4P | 300.5P | 293.4 | 212.83R | 12.48 | 13.35 | 10.39 | 8.60 |
| Apr 1983 | 312.6P | 300.8P | 295.5 | — | 12.67 | 13.34R | 10.43 | 8.60 |
| May 1983 | 313.8P | 301.7P | 297.1 | — | 12.67P | 13.55P | 10.50R | 8.59P |
| Jun 1983 | 315.4P | 302.5P | 298.1 | 215.17P | — | — | 10.53P | 8.67P |

P = Preliminary R = Revised since last month

[1] US Bureau of Labor Statistics, Washington, D.C.; "Producer Prices and Price Indexes," Table 6 (formerly "Wholesale Prices and Price Indexes"). Producer Price Indexes are revised four months after they are first released to reflect the availability of late reports and corrections by respondents.

[2] US Bureau of Labor Statistics, Washington, D.C.; Consumer Price Index for All Urban Consumers, US City Average, All Items.

[3] US Department of Commerce, Washington, D.C.; Bureau of Economic Analysis, National Income and Wealth Division; "Survey of Current Business," Table A. The GNP Implicit Price Deflator is published quarterly, and seasonally adjusted.

[4] US Bureau of Labor Statistics, Washington, D.C.; "Employment and Earnings," Table C-2. All data based on 1972 revision of SIC Manual. Data for 1970-1976 are adjusted to the March 1977 benchmark. Data for 1977-1978 are adjusted to the March 1979 benchmark. Data for January 1979 and beyond are adjusted to the March 1980 benchmark.

[5] Monthly data 1970-1978 for Producer Price Index-Industrial Commodities, Consumer Price Index, and Employment and Earnings SIC codes 10, 333, and 28, and quarterly data for GNP Implicit Price Deflator appear on pages 4.6-4.8 of Nuexco Report 139.
Monthly data 1977-1978 for Employment and Earnings SIC Codes 10, 333, and 28 appear on page 33 of Nuexco Report 147.
Monthly data 1970-1978 for Employment and Earnings SIC Code 36 appear on page 23 of Nuexco Report 154.
Monthly data 1979-1980 for Employment and Earnings, Revised Establishment Data, all listed codes, appear on page 22 of Nuexco Report 158.
Monthly data 1977-1980 for Producer Price Index-All Commodities, appear on page 21 of Nuexco Report 158.

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SEPTEMBER 1983 NUMBER 181

# Monthly Report on the Nuclear Fuel Market

NUEXCO

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## EXECUTIVE SUMMARY
## REPORT 181

| | |
|---|---|
| **Exchange Value $24.00, unchanged** | The **Exchange Value** as of August 31, 1983 is **$24.00** per pound $U_3O_8$, unchanged from last month. Nine uranium sales transactions are reported, involving approximately 2.6 million pounds $U_3O_8$ *equivalent*. Six transactions involved enriched $U_3O_8$ and three involved $UF_6$. |
| **Supply-Demand Ratio Increased slightly to 2.9:1** | **Active** spot and near-term **uranium supply** amounts to 6.7 million pounds $U_3O_8$, *equivalent*, down .4 million pounds from last month. **Active** spot and near-term **uranium demand** fell 8%, to **2.4** million pounds $U_3O_8$ equivalent. Therefore, the spot and near-term **supply-demand ratio** rose slightly, to **2.9:1.** |
| **Transaction Value Rose $.10, to $23.60** | The **Transaction Value** as of August 31, 1983, is **$23.60** per pound $U_3O_8$. It includes 20 transactions involving a total of 2.0 million pounds equivalent $U_3O_8$ and covers a period of five months. |
| **Conversion Value Unchanged at $1.10** | The **Conversion Value** as of August 31, 1983 is **$1.10** per pound U as $UF_6$, unchanged since last month. One secondary market conversion transaction is reported, involving 51-100,000 pounds U as $UF_6$. Active supply remains approximately four times active demand. |
| **Loan Use Charge Rate unchanged at 6%** | The **Loan Use Charge Rate** as of August 31, 1983 is **6 percent** per annum. No uranium loan transactions are reported. |
| **SWU Value: FY 84 $95** | **The SWU Value** as of August 31, 1983 is **$95 per SWU**, unchanged since last month. The price reflects both the continuation of offers to sell large quantities of Eurodif-origin SWUs and USDOE's offer to reduce the SWU price under requirements contracts having 3.5-year termination provisions. Spot and near-term demand for secondary market enrichment services amounts to 630 thousand SWUs, unchanged from last month; spot and near-term supply amounts to 520 thousand SWUs. |
| **SWU Transactions** | This issue reports two sales of enrichment services, involving a total of 125 thousand USDOE-origin SWUs. |
| **Analysis & Commentary** | A comprehensive chronology of the WPPSS nuclear plant construction program. |
| **Canada** | Two CANDUs are shut down temporarily, and a plan exists for commercial use of small research reactors for district heating. |
| **Focus: Australia** | Presently only Nabarlek and Ranger produce uranium in Australia, and the development of several potential sites requires an attitudinal change in the government. |
| **Focus: Canada** | Nuclear reactors under construction will add 40 percent to Canada's consumption over the next eight years, but increasing uranium production could lead nonetheless to an awkward domestic supply overhang. |
| **Japan** | A recent revision in the government's plan for electricity generating capacity reduced the nuclear contribution by 23 percent, reinforcing Nuexco's prediction that the Japanese utilities will have excessive uranium inventories for more than a decade. |
| **United States** | Startup in August for St. Lucie 2 and San Onofre 2; delay for Palo Verde 1. |

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| NUEXCO REPORT 181<br>FIGURES OF THE MONTH<br>(August 31, 1983) | This Month (Report 181) | Last Month (Report 180) | 12 Months Ago (Report 169) |
|---|---|---|---|
| Exchange Value[1] | 24.00 | 24.00 | 17.00 |
| Transaction Value[1] | 23.60 | 23.50 | 19.10 |
| Conversion Value[2] | 1.10 | 1.10 | 0.90 |
| Loan Use Charge Rate[3] | 6% | 6% | 6% |
| Near-Term Uranium Supply[4] | 6.7 | 7.1 | 1.7 |
| Near-Term Uranium Demand[5] | 2.4 | 2.6 | .16 |
| Near-Term Supply-Demand Ratio | 2.9 | 2.8 | 10.6 |
| Recent Uranium Sales: | | | |
| Number of Transactions[6] | 9 | 5 | 10 |
| Quantity of Material[7] | 1.8-3.9 | 0.8-1.5 | 2.2-4.4 |
| Nuexco SWU Value[8]: | | | |
| FY 84 | 95.00 | 95.00 | — |
| USDOE SWU Prices[8]: | | | |
| AFC | 138.65 | 138.65 | 138.65 |
| Requirements | 149.85 | 149.85 | 149.85 |
| Market Value of Enriched UF$_6$[9, 10]: | | | |
| 2.5 w/o U$_{235}$ | 598.47 | 598.47 | — |
| 3.0 w/o U$_{235}$ | 764.27 | 764.27 | — |
| 3.5 w/o U$_{235}$ | 932.90 | 932.90 | — |
| 4.0 w/o U$_{235}$ | 1,103.64 | 1,103.64 | — |

---

[1] US $ per pound U$_3$O$_8$ equivalent

[2] US $ per pound U as UF$_6$

[3] Per annum

[4] Active inquiries to sell, for delivery within 12 months after contract signing (millions of pounds U$_3$O$_8$)

[5] Active inquiries to purchase, for delivery within 12 months after contract signing (millions of pounds U$_3$O$_8$).

[6] Uranium sales only; does not include loans, conversion, or SWU transactions.

[7] Millions of pounds U$_3$O$_8$, equivalent.

[8] US $ per SWU.

[9] Calculated using the Nuexco Exchange Value, Conversion Value, and 0.20 percent tails assay. Calculations before 2/28/83 used the USDOE price for AFC SWUs. As of 2/28/83, calculations use the Nuexco SWU Value for the relevant fiscal year (currently FY 84).

[10] US $ per KgU as UF$_6$.

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## NUEXCO'S URANIUM PRICE FORECAST OF OCTOBER 1980

Remember the fall of 1980, about three years ago? The uranium industry was booming. Consumption was growing rapidly. Electric utilities were building inventory as a precautionary measure against insufficient uranium reserves. Some nuclear plants had been cancelled in the United States as a result of the earlier accident at Three Mile Island, but the nuclear industry was expected to recover. Nuclear power was still expanding in Canada, Europe and the Far East. Free World installed nuclear capacity exceeded 100 GWe and was expected to reach 300 GWe by 1990.

Free World production exceeded 100 million pounds for the first time in 1980. In Australia, Queensland's Nabarlek facility was just underway and ERA's Ranger facility was under construction. In Canada, Amok was preparing for startup at Cluff Lake and Key Lake was being planned. The US produced a record 43 million pounds $U_3O_8$ in 1980, as Phillips proceeded with the Noserock mine and Gulf Minerals with Mt. Taylor. Although spot market prices had declined from peak levels, many people believed that prices would bottom at approximately $30 per pound $U_3O_8$ and rise again to new highs.

Despite these optimistic indicators, the consumption side of the industry was showing definite signs of weakness, and the years beyond 1980 appeared to be a period of increasing uncertainty. High oil prices were hindering electrical load growth and utilities throughout the world were caught in difficult financial conditions. As a result, sixteen nuclear plants had been cancelled in the US within a year.

In October, 1980, Nuexco prepared a spot market forecast with the results as shown in the accompanying graph. The forecast showed trends opposed to industry expectations, but it proved to be reasonably accurate. The exchange value is still within the $5 per pound $U_3O_8$ price band that we predicted three years ago.

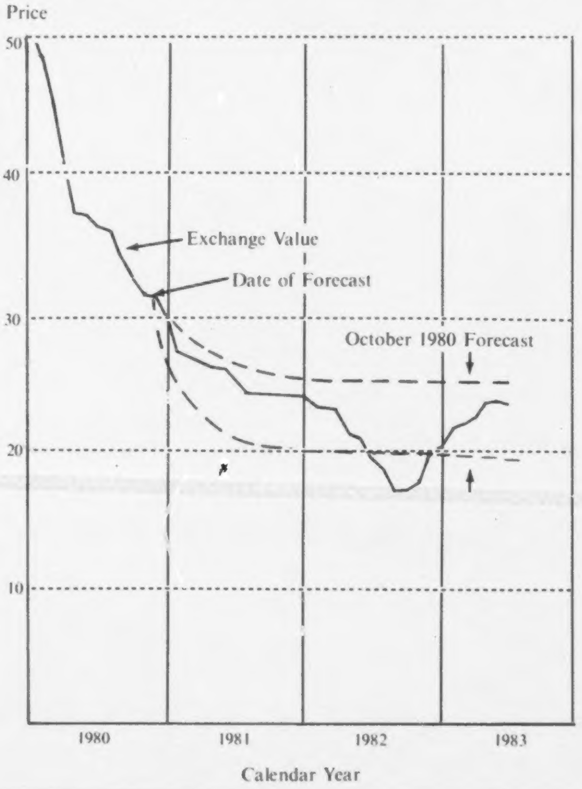
The current report is now available from Nuexco: "Uranium: World Market Study and Price Forecast: 1983 to 1997." The study presents a detailed analysis of future:

Consumption
Production
Inventories
Unfilled Requirements
Uncommitted Production
Production Costs
Spot Market Prices.

Five cases are analyzed for the period 1983 to 1997, including scenarios based on the effects of a US embargo and of different international policies.

For further information, please contact Dick Andersen at our headquarters.

**Nuexco 1980 Forecast**
**Compared to Exchange Value**
**(Mid-1983 Constant Dollars per Pound $U_3O_8$)**



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# MONTHLY REPORT ON THE URANIUM MARKET

September 1983 No. 181

R. WESLEY MILLER, *EDITOR*

*PRICING*

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## FOREWORD

We are deeply saddened by the recent death of A. Payne Kibbe, former Chairman and co-founder of Nuexco. Mr. Kibbe died suddenly on August 21, apparently stricken by a heart attack.

When Payne and George White, Sr., established Nuexco in 1968, they intended to make it possible for utilities to pool their uranium inventories. However, they soon realized that the industry really needed:

1. easier exchanges of ownership and custody of uranium within the industry;
2. market analysis and reporting;
3. an indicator of current spot market price.

Nuexco's current services, and the entire spectrum of uranium fuel cycle brokerage activities evolved out of that realization and are due in large measure to Payne's initiative.

Payne was also involved in numerous other activities. In 1948 he organized his own investment firm, the A. P. Kibbe Co. He remained president of the firm until 1955, when he joined the Atlas Corp.

With Atlas Corp., Mr. Kibbe served as President of the Minerals Division, and went on to become vice president-director and president-director of the corporation.

From 1967 until his death, he was chairman and chief executive officer of Monroc, Inc., a sand and gravel, ready-mix operation in Utah and Idaho.

From 1967 until 1982, he was also founder, president and chief executive officer of Nuexco, Kibbe & Associates (a uranium consulting firm) and Kibbe & Co., (a mineral prospecting and development company). In addition to his other activities, Payne was founder, principal owner and chairman of Swuco, Inc. and served on the board of directors for several other firms.

Payne's contributions as the original Chairman of Nuexco were inestimable. His vision in perceiving his customers' needs, his knowledge of the industry, his business acumen, and his management skills and ability to attract and motivate talented people were essential to Nuexco's growth and success. We will miss him and his counsel.

## NATURAL URANIUM AND CONVERSION

The **Exchange Value** as of August 31, 1983 is **$24.00** per pound $U_3O_8$, unchanged from last month. The *Current Market Data* section of this Report lists nine uranium sales transactions, involving approximately 2.6 million pounds $U_3O_8$, *equivalent*. Six transactions involved $U_3O_8$ and three involved natural $UF_6$.

**Active spot and near-term uranium supply** ($U_3O_8$ or natural $UF_6$ offered at competitive prices, terms, and other conditions) totals 6.7 million pounds $U_3O_8$ equivalent, down 400 thousand pounds from last month. **Active spot and near-term uranium demand** decreased slightly to **2.4 million** pounds $U_3O_8$ equivalent. The spot and near-term **supply-demand ratio** was **2.9:1**, slightly higher than last month's level of 2.8.

The **Transaction Value** as of August 31, 1983, is **$23.60** per pound $U_3O_8$, equivalent, an increase of $.10 since last month. The current Transaction Value includes 20 transactions involving a total of 2.0 million pounds $U_3O_8$ equivalent, and covers a period of five months.

The **Conversion Value** as of August 31, 1983 is **$1.10** per pound U as $UF_6$, the same as last month. One secondary market conversion transaction is reported this month, involving approximately 50-100,000 pounds U. **Active supply** of secondary market conversion services (active inquiries to sell secondary market conversion services for delivery within the next three years) totals **7.0** million pounds U, while **active demand** amounts to **1.7** million pounds, approximately one fourth of supply.

The **Loan Use Charge Rate** remained at **6 percent** per annum. Nuexco is aware of at least three lenders holding a total of more than five million pounds available for loan at 6 percent per annum, half as $U_3O_8$ and half as $UF_6$, but there are few potential borrowers. No loan transactions are reported this month.

* * *

The Exchange Value was unchanged as of August 31. The market's consolidation of its modest $0.50 gain during the month of July was reflected by the closing of several transactions at or near $24.00. Several factors led to the virtual absence of new activities that characterized the market during the month of August.

1. Many spot and near-term buyers reduced their overall levels of market activities during the traditional summer vacation period.
2. The totals of active spot and near-term uranium supply and demand changed only slightly from the previous month.
3. Even though nine transactions representing approximately 2.6 million pounds $U_3O_8$ are reported in the *Current Market Data* section of this Report, six of those transactions representing more than 90 percent of the total quantity are largely attributable to negotiations begun in previous months.
4. The absence of firm purchase requirements allowed buyers to exercise more discretionary judgment with respect to sellers' offers.
5. Buyers, especially European utilities, exhibited greater resistance to sellers' offering prices due to the relatively sharp rise of the US dollar against other currencies.
6. Sellers seemed unwilling to raise their offering prices in the face of the buyers' increased resistance.

Over the past few years, certain uranium producers have tended to lower prices aggressively near the ends of their fiscal quarters, in order to record revenues for financial reporting purposes. Activities in the first eight months of this year suggest that selling pressure of that type has abated, perhaps because of producers' expectations that spot and near-term prices will continue to rise.

* * *

One secondary market conversion transaction involving approximately 50-100,000 pounds U is reported this month. The seller and buyer are both European. The buyer received a number of offers in response to a request for quotations. Most of the offers came from the USA at levels at or near the Nuexco Conversion Value. However, due to the transportation costs associated with any purchase requiring transatlantic shipment, the buyer chose to purchase higher priced secondary market conversion services from a European seller.

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*PRICING*

## ENRICHED URANIUM AND SWUS

As of August 31, 1983, the **SWU Value for FY 1984** is **$95 per SWU,** unchanged from last month. Once again, the SWU Value reflects the prices offered by sellers of large quantities of Eurodif-origin SWUs in response to DOE's Interim Sales Contract (ISC) offer to reduce prices under requirements contracts having 3.5-year termination provision.

As of August 31, spot and near-term demand for secondary market enrichment services amounted to 630 thousand SWUs, unchanged since last month. Active supply of spot and near-term enrichment services in the secondary market amounted to 520 thousand SWUs, down slightly since last month. The *Current Market Data* section reports two transactions for FY 1984 delivery of secondary market enrichment services involving a total of 125 thousand DOE-origin SWUs. A European utility sold 10 thousand SWUs to a US utility and one US utility sold 115 thousand SWUs to another US utility.

* * *

The market for enriched uranium and enrichment services has undergone, over the past year or two, some fundamental changes that have altered DOE's attitude toward competition. DOE's aggressive efforts to maintain 100 percent of the US market have complicated activities in the secondary market. Some of those fundamental changes are discussed in the following paragraphs.

1. For five years or more, DOE has been losing business in *non-US* markets, and particularly in Europe. Much of the loss has resulted from European clients' annoyance with the US non-proliferation policies of President Carter. A related influence has been the desire on the part of DOE's European customers for self-sufficiency throughout the nuclear fuel cycle. For example, West German customers terminated a number of DOE contracts in favor of Techsnabexport (USSR) and Urenco. In other cases, European customers of DOE sold their DOE commitments to US customers of DOE, usually replacing the buyer's corresponding DOE commitment.

2. Two years ago, before Eurodif enrichment services were being offered to the US market, DOE had no domestic competition. Once European SWUs began to penetrate the US market, DOE became concerned about the loss of its domestic market, and reacted with efforts aimed at maintaining market share.

3. DOE's actions appear to be aimed at maintaining 100 percent of the US market and approximately one third of the world's enrichment market. DOE has taken three notable actions with those objectives in mind:

a. By holding SWU prices at their current levels when the latest price determination was made earlier this year, DOE interrupted a string of SWU price increases dating back ten years.

b. The Interim Sales Contract, sometimes called the mini-deal, offers holders of requirements contracts having 3.5 year termination provisions the opportunity to pay the lower AFC price for SWUs, in exchange for which they would agree not to terminate SWU deliveries for FY 83-85.

c. DOE is proposing the US (Utility Services, formerly known as the Facility Requirements) contract, the exact terms and conditions of which have not yet been revealed. The draft version and preliminary comments from DOE indicate that the US contract will give DOE clients more favorable terms and conditions in exchange for the surrender of their rights to use non-US enrichment services.

4. Non-DOE suppliers of enrichment services have large excess capacity and are competing vigorously for the available market. Moreover, the USA is adding capacity and Japan is planning to do so. National nuclear power programs continue to fall well short of planned levels, so there is no possibility that the world's enrichment capacity could be fully utilized during this centry. If DOE succeeds in retaining the US market, it will do so at the expense of Urenco, Eurodif and Techsnabexport.

* * *

Japanese utilities rely primarily on the USDOE for enrichment services. Currently they are reviewing DOE's Interim Sales Contracts (ISC) offered to holders of 3.5-year requirements contracts for FY83-85 deliveries. As is the case throughout the nuclear fuel cycle, Japanese utilities are sensitive to supplier relations and cautious about the future of secondary market prices. Although sellers in the secondary SWU market have reduced their offering prices to remain competitive, the five Japanese companies holding a total of eight USDOE requirements contracts having 3.5-year termination provisions appear to be leaning toward accepting the ISC. However, they would like to delay that decision until they have had the opportunity to study the terms and conditions of the proposed Utility Services contract.

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*CURRENT MARKET DATA*

**EXCHANGE VALUE $24.00/lb. $U_3O_8$**
Determined as of August 31, 1983

**Definition**[1]

The Exchange Value is Nuexco's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the last day of the month.

**Derivation**

Nuexco bases the Exchange Value upon:

A. Data from recently completed transactions.
B. Data from pending transactions.
C. Firm bids to buy and firm offers to sell.
D. Prices purchasers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy, and prices sellers have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell.

**Comments**

Nuexco does not consider the following in determining the Exchange Value:

A. The price of uranium delivered or to be delivered under old contracts.
B. The price of uranium delivered in connection with contract renegotiations or other than arm's length transactions.

[1] In December, 1981, Nuexco published a history of the Exchange Value which chronicled, month-by-month, changes in its definition, usage and derivation. Copies are available upon request.

**TRANSACTION VALUE**[2]
Determined as of August 31, 1983

| $/lb. $U_3O_8$ | Millions of Pounds | Number of Transactions | Number of Months |
|---|---|---|---|
| 23.60 | 2.0 | 20 | 5 |

**Definition**

The Transaction Value is a weighted average price of recent transactions, and is based on prices paid for $U_3O_8$ in transactions closed within the previous three-month period and for which delivery was scheduled within one year of the transaction date. At least ten transactions totaling at least two million pounds $U_3O_8$ are included in each calculation, or the sample time is extended as necessary to include these minima. Foreign currencies are converted to US dollars as of the transaction date.

**Comments**

Nuexco does not consider the following in determining the Transaction Value:

A. The price of uranium delivered in connection with contract renegotiations or other than arm's length transactions.
B. The price of uranium delivered in connection with contracts which call for "market price" mechanisms. This exclusion applies particularly to contracts in which delivery prices are expressed as a function of Exchange Value or any other independent variable. Also excluded from consideration are all data where the delivery price is defined in such a way that it cannot currently be determined.

[2] Transaction Values for 1976 through 1981 and their associated parameters (millions of pounds, number of transactions and number of months) are tabulated on pages 31 and 32 of Report 161. Corresponding data for 1982 are tabulated on page 5 of Report 173.

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*CURRENT MARKET DATA*

**CONVERSION VALUE[1] $1.10/lb. U as $UF_6$**
Determined as of August 31, 1983

**Definition**

The Conversion Value is Nuexco's judgment of the price at which spot and/or near-term transactions for significant quantities of conversion services could be concluded in the secondary market as of the last day of the month.

**Derivation**

Nuexco bases the Conversion Value upon:

A. Data from recently completed transactions.
B. Data from pending transactions.
C. Firm bids to buy and firm offers to sell.
D. Prices purchasers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy, and prices sellers have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell.

**Comments**

Nuexco does not consider the following in determining the Conversion Value:

A. The price of conversion services delivered or to be delivered under old contracts.
B. The price of conversion services delivered in connection with contract renegotiations or other than arm's length transactions.

[1] Monthly data for 1981 and 1982 are tabulated on page 6 of Report 173.

**LOAN USE CHARGE RATE[2] 6%**
Determined as of August 31, 1983

**Definition**

The Loan Use Charge Rate is Nuexco's judgment of the annual interest rate at which uranium loans could be concluded as of the last day of the month.

**Derivation**

Nuexco bases the Loan Use Charge Rate upon:

A. Data from recently completed or pending loan transactions.
B. Rates included in firm proposals to borrow or lend.
C. Rates that potential borrowers and lenders have expressed as a willingness to pay or accept, but for which Nuexco is not aware of firm proposals.

[2] Monthly data for 1968 through 1981 appear on pages 32-34 of Report 162. Monthly data for 1982 appear on page 2 of Report 173.

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*CURRENT MARKET DATA*

**SWU VALUE $95/SWU for FY84**
Determined as of August 31, 1983

**Definition**

The SWU (Separative Work Unit) Value is Nuexco's judgment of the price, expressed in US dollars per SWU, at which transactions for the sale of significant quantities of SWU of any origin for delivery in the specified DOE fiscal year could be concluded as of the last day of the month.

**Derivation**

Nuexco bases the SWU Value upon:

A. Data from recently completed transactions.
B. Data from pending transactions.
C. Firm bids to buy and firm offers to sell.
D. Prices purchasers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy, and prices sellers have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell.
E. SWU prices at varying tails assays and varying product assays are converted to the equivalent SWU price at the DOE Reference Transaction Tails Assay (presently 0.20 weight percent $U_{235}$) and a product assay of three percent $U_{235}$ assuming feed costs calculated using the Nuexco Exchange Value and Nuexco Conversion Value determined as of the last day of the same month.

**Comments**

Nuexco does not consider the following in determining the SWU Value:

A. The price of SWU delivered under long-term contracts from primary suppliers, such as DOE, Urenco, or Eurodif.
B. The price of SWU delivered under other than arm's length transactions.

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*CURRENT MARKET DATA*

## EXCHANGE VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

| Country (currency) | per lb. $U_3O_8$ in Concentrates | per kg $U_3O_8$ in Concentrates | per kg U in Concentrates |
|---|---|---|---|
| Australia (dollar) | 27.28 | 60.15 | 70.93 |
| Belgium (comm. franc) | 1,294 | 2,852 | 3,364 |
| Canada (dollar) | 29.58 | 65.21 | 76.90 |
| Finland (markka) | 137.58 | 303.30 | 357.66 |
| France (franc) | 194.11 | 427.94 | 504.65 |
| FRG (mark) | 64.48 | 142.16 | 167.64 |
| Italy (lira) | 38,523 | 84,929 | 100,152 |
| Japan (yen) | 5,911 | 13,032 | 100,152 |
| Netherlands (guilder) | 72.17 | 159.11 | 187.62 |
| South Africa (rand) | 26.96 | 59.44 | 70.09 |
| Spain (peseta) | 3,647 | 8,041 | 9,482 |
| Sweden (krona) | 189.74 | 418.31 | 493.29 |
| Switzerland (franc) | 52.39 | 115.51 | 136.21 |
| UK (pound) | 16.02 | 35.31 | 41.64 |
| US (dollar) | 24.00 | 52.91 | 62.39 |

## TRANSACTION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

| Country (currency) | per lb. $U_3O_8$ in Concentrates | per kg $U_3O_8$ in Concentrates | per kg U in Concentrates |
|---|---|---|---|
| Australia (dollar) | 26.83 | 59.14 | 69.75 |
| Belgium (comm. franc) | 1,272 | 2,805 | 3,308 |
| Canada (dollar) | 29.09 | 64.13 | 75.62 |
| Finland (markka) | 135.28 | 298.25 | 351.70 |
| France (franc) | 190.88 | 420.81 | 496.24 |
| FRG (mark) | 63.41 | 139.79 | 164.84 |
| Italy (lira) | 37,881 | 83,514 | 98,483 |
| Japan (yen) | 5,813 | 12,815 | 15,112 |
| Netherlands (guilder) | 70.97 | 156.45 | 184.50 |
| South Africa (rand) | 26.51 | 58.45 | 68.92 |
| Spain (peseta) | 3,587 | 7,907 | 9,324 |
| Sweden (krona) | 186.58 | 411.34 | 485.07 |
| Switzerland (franc) | 51.52 | 113.58 | 133.94 |
| UK (pound) | 15.75 | 34.72 | 40.94 |
| US (dollar) | 23.60 | 52.03 | 61.35 |

[1] Calculated using currency exchange rates published in the Wall Street Journal on August 31, 1983.

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## CONVERSION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

| Country (currency) | per lb. U as $UF_6$ | per kg U as $UF_6$ |
|---|---|---|
| Australia (dollar) | 1.25 | 2.76 |
| Belgium (comm. franc) | 59.30 | 130.73 |
| Canada (dollar) | 1.36 | 2.99 |
| Finland (markka) | 6.31 | 13.90 |
| France (franc) | 8.90 | 19.61 |
| FRG (mark) | 2.96 | 6.52 |
| Italy (lira) | 1,766 | 3,893 |
| Japan (yen) | 270.94 | 597.31 |
| Netherlands (guilder) | 3.31 | 7.29 |
| South Africa (rand) | 1.24 | 2.72 |
| Spain (peseta) | 167.17 | 368.55 |
| Sweden (krona) | 8.70 | 19.17 |
| Switzerland (franc) | 2.40 | 5.29 |
| UK (pound) | 0.73 | 1.62 |
| US (dollar) | 1.10 | 2.43 |

## SWU VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

| Country (currency) | FY 1984 per SWU |
|---|---|
| Australia (dollar) | 107.99 |
| Belgium (comm. franc) | 5,121 |
| Canada (dollar) | 117.09 |
| Finland (markka) | 544.57 |
| France (franc) | 768.36 |
| FRG (mark) | 255.24 |
| Italy (lira) | 52,488 |
| Japan (yen) | 23,399 |
| Netherlands (guilder) | 285.67 |
| South Africa (rand) | 106.72 |
| Spain (peseta) | 14,438 |
| Sweden (krona) | 751.07 |
| Switzerland (franc) | 207.39 |
| UK (pound) | 63.40 |
| US (dollar) | 95.00 |

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[1] Calculated using currency exchange rates published in the Wall Street Journal on August 31, 1983.

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*CURRENT MARKET DATA*

## RECENT TRANSACTIONS[1]

### Uranium Sales

| Nuexco Transaction Number | Delivery Period | Approximate Quantity (thousands of pounds, $U_3O_8$ equivalent) | Approximate Price as Percent of Current E.V. | Seller | Buyer | Remarks |
|---|---|---|---|---|---|---|
| 2408 | 1983-84 | 301-600 | 98 | Canadian Producer | US Utility | |
| 2413 | 1984 | 51-100 | 99 | European Entity | US Utility | $UF_6$ |
| 2416 | 1984 | 51-100 | 100 | European Entity | US Utility | $UF_6$ |
| 2433 | 1984 | 101-300 | indeterminate | Canadian Producer | European Utility | $UF_6$<br>Not arm's length |
| 2434 | 1983 | 51-100 | 100 | US Producer | US Utility | |
| 2442 | 1984-88 | 301-600 | indeterminate | US Producer | US Utility | Price related to market |
| 2444 | 1983-86 | 1001-2000 | unknown | Canadian Producer | Unknown | |
| 2448 | 1983 | Less than 50 | 100 | European Producer | US Producer | |
| 2450 | 1983 | Less than 50 | 100 | US Producer | US Utility | |

### Secondary Market Conversion Services

| Nuexco Transaction Number | Delivery Period | Approximate Quantity (thousands of pounds, U equivalent) | Approximate Price as Percent of Current C.V. | Seller | Buyer | Remarks |
|---|---|---|---|---|---|---|
| 2449 | 1983 | 51-100 | 216 | European Entity | European Utility | Included other considerations |

### Secondary Market Enrichment Services

| Nuexco Transaction Number | Delivery Period[2] | Approximate Quantity (thousands of SWUs) | Approximate Price[3] as Percent of Current SWU Value | Tails Assay (Percent $U_{235}$) | Buyer Group | Seller Group | SWU Origin | Remarks |
|---|---|---|---|---|---|---|---|---|
| 2359 | 1984 | 10 | 118 | .20 | US Utility | European Utility | DOE | |
| 2431 | 1984 | 115 | 122 | .30 | US Utility | US Utility | DOE | |

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[1] Transactions listed are not limited to those in which Nuexco was involved, but also include others of which Nuexco is aware.

[2] Q refers to quarter of calendar year, not fiscal year.

[3] Price is not normalized to 0.20% tails assay.

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## URANIUM SUPPLY
## (As of 8/31/83)

| Nuexco | Delivery Period[1] (Thousands of Pounds $U_3O_8$) | | Remarks |
|---|---|---|---|
| Project Number | Spot or Near-term[2] | Intermediate or Long-term[3] | |
| **Available for Sale:** | | | |
| **ACTIVE** | | | |
| 1575 | | 500 per year | long term |
| 1818 | | 250 per year | long term |
| 2017 | | 2,300 | |
| 2038 | 2,000 | | $UF_6$ |
| 2134 | | 300 per year | 1984 on |
| 2191 | 125 | | $UF_6$ |
| 2193 | | 800 per year | 1986-90 |
| 2201 | 30 | | |
| 2203 | 1,200 | | |
| 2220 | 150 | | $UF_6$ |
| 2235 | | 100 per year | 1985-87 |
| 2236 | | 200 per year | 1985-89 |
| 2246 | 40 | 100 | |
| 2275 | 70 | | |
| 2288 | 80 | | $UF_6$ |
| 2297 | 60 | 200 per year | 1985-89 |
| 2300 | 100 | | $U_3O_8$ or $UF_6$ |
| 2307 | 900 | | $UF_6$ |
| 2309 | 1,000 | | |
| 2315 | 450 | | $UF_6$ |
| 2315A | | 950 | $UF_6$ |
| 2320 | 350 | | $UF_6$ |
| 2331 | 160 | | $UF_6$ |
| TOTAL: | 6,715 | | |
| **INACTIVE** | | | |
| 1877 | 40 | | |
| 2118A | 300 | | $U_3O_8$ or $UF_6$ |
| 2121 | 600 | | |
| 2271 | | 500 per year | 1984-88 |
| 2274 | | 500 per year | 1985-91 |
| TOTAL: | 940 | | |

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[1] Measured from the date of this Report

[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

[3] For delivery beyond one year.

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*CURRENT MARKET DATA*

## URANIUM DEMAND
(As of 8/31/83)

| Nuexco Project Number | Delivery Period[1] (Thousands of Pounds $U_3O_8$) | | Remarks |
|---|---|---|---|
| | Spot or Near-term[2] | Intermediate or Long-term[3] | |
| **Inquiries to Purchase:** | | | |
| **ACTIVE** | | | |
| 1459 | | 200 per year | 1985 on |
| 2010 | | 400 per year | 1984-92 |
| 2167 | 250 | 250 per year | 1984-99 |
| 2187 | 200 | | |
| 2188 | | 250 per year | 1985 on |
| 2233 | 700 | | 1984, $U_3O_8$ or $UF_6$ |
| 2304 | | 500 per year | 1988 on |
| 2310 | 500 | | enriched $UF_6$ |
| 2313 | | 200 | |
| 2316 | 150 | | $UF_6$ |
| 2317 | 550 | | |
| TOTAL: | 2,350 | | |
| **INACTIVE** | | | |
| 1999 | | 50 per year | 1985-90 |
| 2025 | | 350 | |
| 2114 | | 75 per year | 1984 on |
| 2115 | | 200 per year | 1986 on |
| 2214 | 400 | | $UF_6$ |
| 2244 | | 350 per year | 1985 on |
| TOTAL: | 400 | | |

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[1] Measured from the date of this Report.
[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.
[3] For delivery beyond one year.

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## LOAN SUPPLY AND DEMAND
(As of 8/31/83)

| Nuexco Project Number | Delivery Period[1] (Thousands of Pounds $U_3O_8$) Within 1 Year | Beyond 1 Year | Remarks |
|---|---|---|---|
| **Available for Loan:** | | | |
| **ACTIVE** | | | |
| 1815 | 1,000 | | $UF_6$ |
| 1938 | 1,500 | | $UF_6$ |
| 2128 | 2,500 | | |
| TOTAL: | 5,000 | | |
| **INACTIVE** | | | |
| 1884 | 600 | | |
| 2036 | 500 | | $UF_6$ |
| 2139 | 2,000 | | |
| TOTAL: | 3,100 | | |
| **Inquiries to Borrow:** | | | |
| **ACTIVE** | | | |
| 2118 | 250 | | $U_3O_8$ or $UF_6$ |
| TOTAL: | 250 | | |
| **INACTIVE** | None | | |

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[1] Measured from the date of this Report

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*CURRENT MARKET DATA*

## CONVERSION DEMAND
## (As of 8/31/83)

| Nuexco Project Number | Delivery Period[1] (Thousands of Pounds U as $UF_6$) |  | Remarks |
|---|---|---|---|
|  | Within 3 Years | Beyond 3 Years |  |
| **ACTIVE** |  |  |  |
| 1609 | 1,500 |  |  |
| 1840 | 130 |  |  |
| 1936 | 1,500 | 200 per year | Long Term |
| 2051 | 1,500 |  |  |
| 2141 | 1,500 |  |  |
| 2143 | 400 |  |  |
| 2220 | 400 |  |  |
| 2222 | 80 | 175 |  |
| TOTAL: | 7,010 |  |  |
| **INACTIVE** |  |  |  |
| 2181 | 2,000 | 650 per year | Long Term |
| 2230 | 300 |  |  |
| TOTAL: | 2,300 |  |  |

## CONVERSION SUPPLY
## (As of 8/31/83)

| Nuexco Project Number | Delivery Period[1] (Thousands of Pounds U as $UF_6$) |  | Remarks |
|---|---|---|---|
|  | Within 3 Years | Beyond 3 Years |  |
| **ACTIVE** |  |  |  |
| 2129 | 900 |  |  |
| 2199 | 650 |  |  |
| 2188 |  | 225 per year | 1985 on |
| 2253 | 170 |  |  |
| TOTAL: | 1,720 |  |  |
| **INACTIVE** |  |  |  |
| 2135 | 400 | 135 per year | 1986-87 |
| 2190 | 400 | 200 per year | 1986 on |
| 2194 |  | 300 per year | 1986 on |
| 2295 | 250 |  |  |
| TOTAL: | 1,050 |  |  |

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[1] Measured from the date of this Report.

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## ACTIVE SWU SUPPLY
### (As of 8/31/83)

| Nuexco Project Number | Delivery Period[1] (Thousands of SWUs) Spot or or Near-term[2] | Intermediate or Long-term[3] | Remarks |
|---|---|---|---|
| 1859 | — | 5,000 | |
| 1971 | — | 250 | |
| 1984 | 120 | — | |
| 2100 | — | 200 | |
| 2192 | — | 410 | |
| 2273 | 150 | — | |
| 2285 | 250 | 6,000 | |
| 2293 | — | 250 | |
| TOTAL: | 520 | | |

## ACTIVE SWU DEMAND
### (As of 8/31/83)

| Nuexco Project Number | Delivery Period[1] (Thousands of SWUs) Spot or or Near-term[2] | Intermediate or Long-term[3] | Remarks |
|---|---|---|---|
| 1850 | — | 500 | |
| 1856 | — | 500 | |
| 1860 | 240 | 760 | |
| 2117 | — | 200 | |
| 2233 | 250 | — | |
| 2237 | — | 150 per year | 84 and beyond |
| 2308 | 140 | — | |
| TOTAL: | 630 | | |

[1] Measured from the date of this Report.
[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.
[3] For delivery beyond one year.

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*RECENT DEVELOPMENTS*

## CANADA

CANDU reactors (pressurized heavy water-moderated and -cooled) have a superior operating record: of the top six nuclear stations in the Free World ranked by average lifetime capacity factor, five are CANDUs. Consequently, the occurrence of problems with two CANDUs in one week in August is noteworthy.

On August 1 the first pressure tube rupture ever in a CANDU reactor occurred in Pickering Unit 2 (Ontario Hydro). Radioactive heavy water escaped from the fuel channel in the form of superheated steam, condensed inside the reactor building and collected on the floor. The subsequent removal of 12 fuel bundles was hampered by steam damage to two fueling machines.

On August 4 a leak of seven liters of radioactive water from the cooling system of Pickering Unit 1 caused a shut-down. The leak was from a tube in a moderator heat exchanger and allowed radioactive tritium to reach Lake Ontario. The utility is plugging additional tubes in the heat exchanger during the shutdown.

Facing a setback similar to those frequently experienced by other utilities, Ontario Hydro will not have Units 1 and 2 back in operation until October at the earliest.

* * *

The Canadian government is considering a plan for Slowpoke III 2 MWe reactors to supply heat to northern Canadian communities. The Slowpoke III is part of a series of small units designed originally for research use in universities. The proposal to use the design commercially may have a long-term effect on the market for uranium. Although the reactors consume little fuel and have been proposed for use only as hot water generators in remote regions, the success of such a program ultimately could increase public acceptance of nuclear energy in general and improve the business climate for utilities. Furthermore, the widespread use of nuclear power for district heating one day would make a substantial contribution to uranium demand. In that event, uranium would cease to be a single purpose commodity.

## JAPAN

The Electric Power Resources Development Coordination Council (EPRDCC) of the Ministry of International Trade and Industry (MITI) recently announced another in a series of changes to the government's long-term plan for the development of electricity generating capacity. Table 1 summarizes the planned distribution of electricity sources.

**Table 1**

**GOVERNMENT PLAN FOR ELECTRICITY GENERATING CAPACITY**

| Source | Installed by 1991 (MWe) | Percent of Total |
|---|---|---|
| Hydro Electric | 37,600 | 19.9 |
| Fossil Fuel | 115,900 | 61.4 |
| Nuclear | 35,300 | 18.7 |
| TOTAL | 188,800 | |

The planned nuclear power contribution of 35,300 MWe represents a 23 percent reduction from the 46,000 MWe target announced by the EPRDCC earlier this year. The reduction reflects a reappraisal of Japan's overall economic growth and the related growth of demand for electricity, and marks an adjustment to the realities of nuclear power plant licensing and construction.

The Japanese utilities had anticipated a "realistic" nuclear power generating capacity of 37,350 MWe by 1991, a figure almost 20 percent lower than previous government projections (Nuexco Report 179, July 1983). The new government target of 35,300 MWe constitutes an endorsement of current industry plans. Nuexco's latest published forecast anticipates approximately 33,500 MWe of nuclear generating capacity by 1991. Presently installed capacity is 17,177 MWe, so the achievement of this reduced target would still represent an increase of approximately 100 percent in the next eight years.

Most Japanese utilities committed themselves in the 1970s to long-term uranium contracts that would have supported the growth of nuclear capacity to as much as 60,000 MWe by 1985. The government's reduction of its official target for 1991 reinforces Nuexco's previously stated conclusion that Japanese utilities' collective fuel needs will be met under existing contracts at least until the mid-1990s. According to Nuexco's estimates:

1. Nuclear plants in Japan will consume an average of 10 to 12 million pounds $U_3O_8$ per year over the next decade.
2. The country's current inventory amounts to more than 100 million pounds $U_3O_8$ equivalent, in various forms.
3. Approximately 200 million pounds are scheduled for

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delivery under current contracts.

4. The total inventory, in all forms, could exceed 200 million pounds by 1995.

The determination of what inventory level is desirable depends on the buyer's unique situation and outlook, but in the case of Japan, there is general agreement on the existence of a large surplus. The amount desirable has not yet been decided, but one Japanese analyst has estimated that as much as 50 million pounds equivalent $U_3O_8$ will be excess by the end of this decade. The question of whether to take any action to reduce the surplus is subject to the interaction of several conflicting factors.

1. Disposing of surplus inventory in the secondary market would improve a utility's cash flow situation, due to the reduction of interest charges, as well as to the cash received from the sale.

2. It would be politically difficult for a Japanese utility to sell uranium at a price lower than the prices that it is paying presently or that it has paid in the past under long-term contracts.

3. The inventory surplus has not yet reached the levels anticipated for 5-10 years from now, so there is little perceived urgency to act.

4. The sale of uranium would certainly appear risky to a typically conservative Japanese utility, even though other analysts having different motivations and different circumstances might consider it more risky to maintain a large surplus.

* * *

In recent related events:

1. Tokyo Electric Power Co. (TEPCO) successfully initiated test operation of its Fukushima II-2 BWR (1100 MWe) and commercial operation is scheduled for January 1984. TEPCO's nuclear capacity at that time will be 6,900 MWe, or 19 percent of its total generating capacity.

2. Tohoku Electric Power has begun public hearings prior to licensing application for its Onagawa-2 BWR (825 MWe). Commercial operation is scheduled for 1992.

3. Kansai Electric Power plans public hearings for its Ohi plants 3 and 4 (both 1200 MWe PWRs) in January 1984. Commercial operation for the plants is scheduled for 1990 and 1991, respectively.

## UNITED STATES

In early August San Onofre Unit 2, an 1100 MWe PWR, began full power operation in North San Diego County. Building was begun in 1974 on Unit 2 and on Unit 3, which Southern California Edison expects will reach criticality this month.

* * *

Report 180 for August 1983 contains an error on page 16 in the US Recent Developments section. The last sentence of the third paragraph states that Florida Power and Light Company is expected to bring St. Lucie 2 on line next year. Actually St. Lucie 2 commenced full capacity commercial operation on August 8, 1983, less than six years after ground was broken.

The US Recent Developments section of Report 180 also discusses the possibility of a delay in the operation of Arizona Public Service Company's Palo Verde 1 reactor because of damage to the coolant pumps and control rod drive mechanisms incurred during a hot functional test. Fuel loading will in fact be postponed from November 1983 until May 1984 and full power operation is not expected until the end of 1984.

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*ANALYSIS & COMMENTARY*

## A CHRONOLOGICAL SUMMARY OF THE WPPSS NUCLEAR POWER PLANT CONSTRUCTION PROGRAM

**1957** Nineteen operating public utility districts and the cities of Ellensburg, Richland, Seattle, and Tacoma form the Washington Public Power Supply System (WPPSS). Working as a municipal corporation and a joint operating agency, WPPSS is set up to build dams and power plants. Headquarters are located in the small city of Richland in southeastern Washington. The growth prospects in the Pacific Northwest look especially bright (7 percent annually). Many of the 23 members of the agency's board are farmers or small businessmen who are neophytes in the nuclear business. Most of the 88 utilities involved are owned by municipalities. There are only four investor-owned utilities; they are not represented on the WPPSS executive board but they are represented on the owners' committee. Washington Water Power (Spokane) and Puget Sound Power and Light (Bellevue) each own 5percent interests in Unit 3. Portland General Electric and Pacific Power and Light each own 10 percent shares of Unit 3. Pacific Power and Light also owns 10 percent of Unit 5. WPPSS owns the balance but splits its vote with BPA on the owners committee.

[The Bonneville Power Administration (BPA) is a US government agency that sells electricity from federal dams to northwestern utilities. BPA's administrator since 1977 has been Peter T. Johnson. The former chief (1972-77) was Donald Hodel, now US Energy Secretary.]

**1972–1975** Following BPA projections of high growth rates, WPPSS orders Units 1, 2 and 3. BPA backs all the bonds issued for Units 1 and 2, and 70 percent of the bond value for Unit 3. Unit 1 is a 1250 MWe (net) PWR to be supplied by Babcock & Wilcox and located at Richland, Washington. Unit 2 is an 1100 MWe (net) BWR to be supplied by General Electric and located at Richland, Washington. Unit 3 is a 1240 MWe (net) PWR to be supplied by Combustion Engineering and located at Satsop, Washington.

**March 1973** Construction permit (CP) issued for Unit 2.

**1975** Standard and Poor's Corp. (S&P) rates the Unit 1-3 bonds AAA (until January 14, 1983). Moody's Investors Service (Moody's) rates them at A1 (until May 1983).

**1977** Because of a barrage of unusually heavy rains, mud slides occur in the 8.5 million cubic yards of dirt (an entire hillside) that had to be relocated at a plant site to build stable foundations. Cleanup, overtime pay, and restocking the Chehalis river with fish cost WPPSS $20 million.

**April 1978** Unit 3 receives CP.

**1980** BPA warns WPPSS that power demand in the 1980s is still going to outstrip supply. WPPSS orders Units 4 and 5, essentially identical to Units 1 and 3, respectively. A change in federal rules passed by Congress in 1973 makes it impossible for BPA to back the Units 4 and 5 bonds and maintain its tax-exempt status. Instead the bonds are supported by "take or pay" contracts with 88 utilities in Washington, Oregon, Idaho, Montana, Wyoming, and Nevada. The "take or pay" contracts are thought to require the utilities to pay for the projects whether electricity is eventually delivered or not.

**1980** S&P rates the units 4 and 5 bonds A (until January 1982). Moody's rates them A1 (until June 1981).

**March 1981** WPPSS files a suit against Exxon Nuclear to protect itself from "an anticipatory breach of contract" relating to $500 million in nuclear fuel. The uranium market price exceeds by far the signed contract price. Exxon has indicated that delays and design changes render the contract unworkable.

**June 1981** WPPSS sells 340,500 DOE SWUs. The SWUs, from Units 4 and 5, are scheduled for delivery in FY 86, 87.

**Nov. 3, 1981** Washington State voters approve Initiative 394 requiring voter approval before bonds can be issued to complete Units 1-3. The initiative is supported by the "Don't Bankrupt Washington Committee." The initiative would become effective on July 1, 1983.

**November 1981** WPPSS breaches its uranium contract with Western Nuclear, refusing deliveries slated for Units 4 and 5. The breached contract accounts for nearly 80 percent of Western Nuclear's anticipated revenues in 1982 and 90 percent in 1983.

**December 1981** WPPSS files suit against Western Nuclear and its parent Phelps Dodge in the US District Court for Western Washington (Judge Walter T. McGovern). WPPSS claims Western Nuclear and 10 other suppliers conspired to fix prices and that the uranium contract with Western Nuclear should be voided.

**End of 1981** Unit 1 is 53 percent complete. Unit 2 is 88 percent complete. Unit 3 is 43 percent complete.

**1982** The total projected price of $4.1 billion for the projects has exploded to $23.8 billion.

**Jan. 7, 1982** Moody's suspends ratings on bonds issued in connection with Units 4 and 5, citing the likelihood that the plants would be terminated.

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**January 1982** Over the past 3 years, BPA has raised its wholesale electric rates three times for a compounded increase of 478 percent. Projected construction cost of Units 1-3 has increased from $3.1 billion to $12.5 billion.

**Jan. 20, 1982** WPPSS wants to buy 6.4 million pounds of $U_3O_8$ for Unit 3 and 5.5 million pounds for Unit 2 for reloads between 1987 and 1996. The bidding deadline is set at March 15.

**Jan. 22, 1982** The WPPSS executive board votes to cancel Units 4 and 5. The decision still has to be approved by the owners' committee (88 utilities).

**January 1982** S&P downgrades its ratings on Unit 4 and 5 bonds from A to BBB+. Ratings on 7 of the cancelled project participants are also downgraded: Public Utility District (PUD) No. 1 of Snohomish County, PUD No. 1 of Clark County, PUD No. 1 of Grays Harbor City, PUD No. 1 of Springfield, Oregon, PUD No. 3 of Mason County, PUD No. 2 of Pacific County, PUD City Division of Tillamook, Oregon.

**Feb. 5, 1982** The owners committee accepts the cancellation of Units 4 and 5. Consequences: $343 million in contract closeout costs (not counting $188 million already spent in contract closeouts since October 1981) and nearly $30 billion in bond principal and interest over the next 30 years. The termination plan (for over 150 site contractors) requires a $94.6 million loan commitment from the public utility district partners in WPPSS and the one investor-owned utility involved (Pacific Power and Light, 10 percent).

**February 1982** WPPSS sells 266,730 DOE-origin SWUs, formerly scheduled for Unit 5, for 8/82 delivery.

**February 1982** Gardinier Inc. offers to settle the disputed 1976 contract for slightly more than the $25.3 million WPPSS figured it needed to buy out its commitment to take approximately 5.4 million pounds of uranium remaining to be delivered. The contract price is $59.05/lb versus $23.50/lb for the current market price, but Gardinier's production costs and future capability are not as favorable as expected.

**March 1982** WPPSS, in breach of contract with Western Nuclear for refusing uranium deliveries, is ordered by a federal court in Washington State to pay the amount by which the contract price exceeds the market price—$53.6 million. Western Nuclear moves in a court in Oklahoma to attach the $UF_6$ (value estimated at $56 million) and WPPSS appeals in San Francisco. Antitrust allegations against Western Nuclear are dismissed but WPPSS will appeal in Seattle before Judge McGovern.

**March 15, 1982** WPPSS extends until April 15 the deadline for filing bids to supply uranium for Unit 2 and Unit 3. Since these reloads are subject to litigation with Exxon, observers believe WPPSS solicits bids in order to elicit a price for use in estimating damages relative to that litigation.

**April 1982** Fuel supplies for the WPPSS plants are as follows:

Unit 1: First core fabricated.
First core (from Unit 4) enriched.
3 million pounds $U_3O_8$ plus Western Nuclear contract.
500,000 pounds $U_3O_8$ acquired from Gardinier.
380,000 KgU as $UF_6$, acquired from Rio Algom.

Unit 2: First core fabricated.
250,000 pounds $U_3O_8$ in inventory.
Reloads through 1994 to be supplied by Exxon (in litigation).

Unit 3: First core enriched.
Reloads through 1996, to be supplied by Exxon (in litigation).

Units 4-5: 16,000 pounds $U_3O_8$ in inventory (sold May 12, 1983). All other uranium transferred to Unit 1.

Kerr McGee Commitments: About 3 million KgU of conversion through 1986.

DOE Commitments: Some 300,000-400,000 excess SWUs for sale.

**April 9, 1982** Washington State Initiative 394 is challenged by the Justice Department at the request of the Department of Energy (DOE) as being unconstitutional at both the federal and state levels. Three trustees of the bond funds have already challenged the initiative in court. They are: Seattle First National, Morgan Guaranty Trust Co. (NY), Continental Illinois National Bank and Trust Co.

**April 19, 1982** BPA administrator Peter Johnson recommends to the WPPSS executive board that Unit 1 be deferred for 2 to 5 years. WPPSS executive board president Stanton H. Cain does not support the recommendation.

**April 23, 1982** After the BPA rejection of 14 other options proposed by WPPSS, the WPPSS board unanimously votes to accept the BPA recommendation: Construction on Unit 1 is suspended for as long as 5 years. In the next several months, 6,000 people will lose their jobs, a WPPSS spokesman says. Eventually 15,000 jobs will be the cost of the decision in the tri-cities region.

**April 1982** Unit 1 is 63 percent complete. Unit 2 is 90 percent complete. Unit 3 is 50 percent complete. This month's bond issue will carry the Unit 2 project to completion, says WPPSS and BPA. Unit 2 still needs an additional $566 million in financing. This may be the last bond issue if Initiative 394 is upheld—voters would be able to cut off funds on Unit 3 and never approve resumption of construction on Unit 1.

**June 15, 1982** King County Superior Court Judge Robert M. Elston rules in pretrial deliberations that the contracts signed with Exxon are valid. The Unit 2 and Unit 3 contracts were signed in 1971 and 1973, respectively, each for 14 annual reloads beginning in 1979 and 1982. The main issue to be tried in February 1983 is whether Exxon Nuclear must accept payment as contracted or WPPSS should pay more because of schedule slippages and design changes (from 7X7 to 8X8). (See May 2, 1983.)

**June 20, 1982** WPPSS rejects offers of $29 to $44 per pound $U_3O_8$ from four different uranium suppliers. Despite the litigation with Exxon, fabricators' bids are still being reviewed.

**June 29, 1982** Initiative 394 is ruled unconstitutional by a federal district court in the state of Washington (Tacoma). However, the initiative is allowed to become law, pending appeal.

**July 1982** WPPSS sells 289,000 DOE SWUs for 6/83 and 8/83 deliveries.

**July 1982** Western Nuclear shuts down its uranium operation.

**September 1982** In Eugene, Oregon, Judge George Woodrich rules that 11 public utilities from Oregon did not have the statutory power to sign "take or pay" agreements with WPPSS on Units 4 and 5 and are freed from any obligation to pay off the related bonds. Several similar law suits are pending in Washington State.

**October 1982** Donald Rausch, president of Western Nuclear, claims a loss of $31 million because of court delays in a trial intended to determine damages stemming from a breached uranium contract with WPPSS.

**October 8, 1982** Washington State Court Judge Joseph Coleman states in a summary judgment that 88 municipal utilities must pay interest and debt service on 2.25 billion in bonds on Units 4 and 5. This statement contradicts two earlier state court decisions in Oregon and Wyoming. The overall outcome still depends on the contract validity issue (see June 15, 1982).

**November 1982** Eleven Washington Public utilities charging that the federal government coerced them into backing Units 4 and 5 are suing the U.S., the current BPA administrator (Peter Johnson), and the Energy Secretary (Donald Hodel) to pay their share of the debt as well as some legal costs incurring from the cancellation of the two units. The 11 utilities own one-third of the projects.

**January 1983** The Ninth U.S. Circuit Court of Appeals upholds the decision by a Washington federal court that found Initiative 394 unconstitutional.

**Feb. 17, 1983** Unit 1 is 63 percent complete. Unit 2 is 95 percent complete. Unit 3 is 70 percent complete.

**Feb. 25, 1983** After a record-breaking completion rate of 2 percent per month, WPPSS decides to cut back to four workdays per week for Unit 3. WPPSS also votes deferral of purchases of any equipment not on the critical path. Unit 1 is already down to low activity with a work force of only 600.

**Feb. 28, 1983** S&P lowers its ratings on Unit 4 and 5 bonds from B to CC.

**March 1983** Because of the pervasive involvement of BPA, DOE's Oak Ridge Operations Office (ORO) decides to grant WPPSS a penalty-free schedule adjustment of 84-86 deliveries of 300,000 SWUs for up to 5 years for Unit 1.

**April 19, 1983** A dozen of the 65 participants in Unit 4 and 5 agree to pay their share of the $30 million debt into an escrow account.

**May 2, 1983** King County Superior Court Judge Robert Elston rules that the Exxon-WPPSS uranium contracts are enforceable at the initial prices regardless of the schedule slippage and design changes. This ruling would save WPPSS $350 million ($500 million estimated current value minus $150 million contract value).

**May 1983** S&P suspends its ratings on Unit 1-3 bonds.

**May 11, 1983** Moody's slashes its ratings on Unit 1-3 bonds from single-A-1 to Baa (3 notches).

**May 12, 1983** Unit 2 is 96 percent complete and requires $150 million to be completed. Fuel loading, initially scheduled for February 1984, could be postponed by construction delays.

**May 12, 1983** WPPSS sells 6,037 KgU as $UF_6$ (15,774 pounds $U_3O_8$ equivalent) from the Unit 5 inventory and 54,000 KgU as $UF_6$ from Unit 2.

**May 12, 1983** The utilities have paid about $28 million into an escrow account but WPPSS does not have access to the funds. Currently, WPPSS has only about $31 million left in its account for the two units.

**May 13, 1983** S&P suspends its AA rating on $6 billion of bonds issued for Units 1, 2, and 3.

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**May 15, 1983** Many WPPSS bonds fall by as much as $170 to $180 for each $1000 face amount over three trading days as investors try to unload the bonds despite lack of buyers.

**May 24, 1983** Judge Joseph Coleman of Washington State Superior Court in King County (Seattle) issues a temporary order preventing the bond trustee (Chemical Bank) from declaring Units 4 and 5 bonds in default.

**May 26, 1983** Four investor owned utilities (see June 17, 1983) with part interest in Unit 3 state that financing should be arranged through banks to complete the unit. With a potential unilateral decision by WPPSS to freeze Unit 3, the four utilities might take legal action.

**May 27, 1983** Following a firm recommendation from BPA, the WPPSS executive board votes to suspend work for 3 years on Unit 3 in 30 days if financing does not become available. Work will be at a slower rate until then. The project has only $90-91 million of the estimated $1 billion required to complete Unit 3.

**May 27, 1983** Judge Joseph Coleman backs up his earlier ruling with a written order barring bond holders and their trustee from beginning default proceedings against WPPSS for missing interest payments until ruling is given on the utilities' obligations.

**May 27, 1983** Unit 1 is 63 percent complete. Unit 2 is 96 percent complete. Unit 3 is 75 percent complete.

**May 28, 1983** The WPPSS executive board votes to suspend work on Unit 3 for 3 years. The work force of 3000 will be reduced to a few hundred. This decision adds another $750 million to the 1983 projected cost of $4.9 billion.

**May 31, 1983** Unable to make use of funds paid into an escrow account by the 88 utility participants who backed Units 4 and 5, WPPSS misses the $15.6 million monthly interest payment to New York City's Chemical Bank, the bond trustee.

**June 1, 1983** Moody's suspends its ratings on $6 billion of bonds for Units 1-3 and assigns its Caa rating ("of poor standing") to the projects for Unit 4 and Unit 5.

**June 3, 1983** The four investor-owned utilities (see June 17, 1983) convince WPPSS to try to put together a financing plan to forestall the suspension of construction on Unit 3.

**June 6, 1983** The four investor-owned utilities present their plan to WPPSS for financing Unit 3.

**June 9, 1983** The WPPSS financial officer proposes that the agency seek $960 million in commercial bank financing to prevent a three-year hold on Unit 3. The proposal is not eagerly received by BPA, which would have to guarantee such loans.

**June 10, 1983** Unit 1 is 63 percent complete. Unit 2 is 97 percent complete. Unit 3 is 75 percent complete and about $1 billion is required for completion.

**June 15, 1983** In a surprising decision, the Washington Supreme Court rules by a 7-2 vote that 28 Washington municipal utilities that signed "take or pay" agreements with WPPSS on Units 4 and 5 did not have the statutory power to do so and have no obligation to pay off the bonds. Even if the utilities had to pay off the bonds, Washington electricity rates would still be well below the national average because of the low cost of hydroelectric power.

**June 15, 1983** The big losers in the June 15 ruling are 487 insurers who held $1.85 billion of the bonds by end of 1982. In approximate order, the major ones are: State Farm, American Express, Crum and Forster, Fireman's Fund, Continental Insurance, Hartford Insurance, U.S. Fidelity & Guaranty, Aetna Life and Casualty, Kemper Insurance, CIGNA, CNA. However, their combined assets exceed their liability by more than $60 billion, dwarfing the WPPSS holdings.

**June 15, 1983** Leaders of the Principal underwriting groups for the WPPSS bond issues, Merrill Lynch ($785 million), Smith Barney, Harris Upham & Co. ($645 million), and Phibro-Salomon Brothers Inc. ($530 million) are already being charged with fraud and negligence in several law suits.

**June 15, 1983** Bonds for Units 1, 2, and 3 fall about 4 points. Bonds for Units 4 and 5 fall more than 14 points.

**June 17, 1983** S&P suspends the credit ratings of Pacific Power and Light (BBB), Portland General Electric (BBB–), Puget Sound Power and Light (BBB), and Washington Water Power (BBB+). The four own 30 percent of Unit 3 and would suffer if it is not completed.

**July 5, 1983** Judge Joseph Coleman refuses to lift his temporary restraining order that has prevented Chemical Bank from declaring WPPSS in default.

**July 21, 1983** Senator James McClure (R-Idaho) introduces a senate provision to be added to fiscal 1984 appropriations for the Interior Department. The amendment would create a new entity to issue $1 billion in bonds backed by BPA for the completion of Units 2 and 3, respectively 98 and 75 percent complete. However, the legislative provision never goes through an authorizing committee in either the Senate or the House. Major opponents: Senator Howard Metzenbaum (D-Ohio), Senator William Proxmire (D-Wis.), and Senator Henry Jackson (D-Wash.).

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**July 22, 1983** WPPSS admits in court that interest payments on Unit 4 and 5 bonds will not be made, thus waiving a 90-day period beyond payment due date and allowing Chemical Bank to declare WPPSS in default.

**July 25, 1983** Chemical Bank issues a notice of event, which would normally place WPPSS in default 90 days after receipt, for not paying its debts on Unit 4 and 5 bonds. Because of the July 22 statements, WPPSS is declared in default.

**July 25, 1983** WPPSS transfers to Chemical Bank about $25.7 million of cash and securities. Although more than $2 billion was poured into the cancelled plants, only $500 million of the assets are salable. WPPSS says that Chemical Bank is now the owner of Units 4 and 5. WPPSS has $8 billion in bonds outstanding but is defaulting on only $2.25 billion of its bonds.

**July 26, 1983** Unit 2 is 98 percent complete.

**July 1983** After a quick and quiet approval in the Senate as a rider to an appropriations bill, the financing plan to rescue Units 1-3 is running into stiff opposition in the House of Representatives. Rep. George Hansen (R-Ida.) presented the bill. The subcommittee chairmen involved, Reps. Richard Ottinger (D-NY) and Jim Weaver (R-Ore.), are against the bill.

**August 1, 1983** WPPSS and BPA are sued by 3 utilities (Puget Sound Power and Light, Washington Water Power, Portland General Electric) over the suspension of Unit 3. The suits ask that WPPSS and BPA adhere to the construction schedule under the ownership agreement.

**August 3, 1983** The US Senate becomes deadlocked on the rescue measure that would allow WPPSS to raise construction funds to complete Units 2 and 3, and the dispute leads to postponement of consideration for the Interior funding bill ($7.6 billion) until after the August recess.

**August 4, 1983** Chemical Bank, charging fraud and negligence, sues WPPSS, 23 municipalities represented by the WPPSS executive board, 88 utilities on the owners' committee, the Bonneville Power Administration, and more than 500 individuals who participated in the bond sales for Units 4 and 5. No underwriters of the bonds are named in the suit.

**August 4, 1983** WPPSS is now involved in more than 60 law suits. Last year, WPPSS paid $15.5 million in legal costs, including $2.2 million for Chemical Bank's lawyer. (Since the default, WPPSS no longer pays for Chemical Bank's lawyer.)

**August 1983** If WPPSS succeeds in selling parts of Units 4 and 5, it probably will not get more than 10 cents for every dollar spent because of a glut of nuclear power plant parts on the market.

**August 1983** Out of the $2.25 billion from the defaulted bonds, more than half ($1.2 billion) went for debt service. WPPSS paid $44 million each for two steam turbines still in a warehouse in Lancaster, Pa. Last year it cost WPPSS $44,600 to store the turbines. Two steam generator vessels costing a total of 203.5 million will probably wind up as scrap because of their complexity and size. At one site, WPPSS built an $8.3 million road to support the transport of heavy equipment. (For other expenditures, see 1977 and August 4, 1983.)

**August 9, 1983** A Washington State Judge dismisses a lawsuit by Chemical Bank, freeing 28 northwest municipal utilities and one privately owned utility from paying their share of the $2.25 billion in bond debt for the cancelled units (4 and 5).

**August 15, 1983** Western Nuclear wants to seize WPPSS $UF_6$ to satisfy its $53.6 million damage award. There is a restraining order from the Court of Appeals in San Francisco preventing WPPSS from moving the $UF_6$ until the court decides whether Western Nuclear can attach assets.

**August 15, 1983** The litigation before a US Judge in Tulsa is more complex because Kerr McGee wants the court to rule that Western Nuclear cannot seize the $UF_6$ until Kerr McGee is paid $4.6 million it is claiming for conversion.

**August 15, 1983** The WPPSS antitrust claim that Western Nuclear and 10 other suppliers conspired to fix uranium prices is still pending before Judge Walter McGovern of the U.S. District Court in Seattle. The trial is scheduled to start in September.

**August 25, 1983** WPPSS announces that, following the default, S&P has downgraded WPPSS bonds issued for the construction of Units 4 and 5 from double -C to D, S&P's lowest rating.

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## AUSTRALIA'S POTENTIAL AS A URANIUM-PRODUCING NATION

### Introduction

A nationwide survey recently discovered that approximately two-thirds of Australians 14 years and over think Australia should develop and export its uranium for peaceful purposes, despite their natural concern over safety and the proliferation of nuclear weapons. Furthermore, 59 percent of Australian Labor Party (ALP) voters favor uranium mining and export, while only 26 percent of Australians support full implementation of the ALP party platform calling for a "phasing out" of the uranium industry.

Surveys such as this, although without direct influence, can become significant agents of change when a government is wrestling with policy decisions. Apart from the commercial and economic impracticalities of the policy, the poll indicates that the Australian government's policy runs counter to current public opinion. Australian uranium miners are convinced that the government will heed these figures in the current review of its uranium policy, especially in light of the fact that Australia contains fully 20 percent of the Free World's uranium resources. The miners hope that, despite the disappointing history of ALP decision-making on the uranium question, the current review will lead to a more mature appreciation of Australia's important role and potential influence in the international fuel cycle.

### Uranium Resources

According to estimates by the Australian Atomic Energy Commission (AAEC), Australian resources in the Reasonably Assured category (RAR) recoverable at a cost of less than US$30/lb. $U_3O_8$ amount to 370,000 tonnes $U_3O_8$, representing 20 percent of the Western World's reserves. Australia's share of Estimated Additional Resources (EAR) is even greater. This category has been assessed to contain 435,000 tonnes $U_3O_8$, 25 percent of the Western World's resources. In addition, the AAEC estimates that Australia is endowed with Speculative Resources amounting to 3.1 million tonnes $U_3O_8$ (at 75 percent probability) or more than 4.6 million tonnes $U_3O_8$ (at 50 percent probability).

### Operating Production Centers

Australia's two production centers, Nabarlek and Ranger, have been operating for more than two years. Figure 1 shows their locations in the Northern Territory. Total Australian production in 1982 amounted to 11.7 million pounds $U_3O_8$, including 1.9 million pounds $U_3O_8$ from Mary Kathleen Uranium (MKU), which ceased production in September 1982. Production for 1983 will amount to approximately 10.5 million pounds $U_3O_8$.

**Nabarlek** is the most compact, low-cost project in the world. Its orebody contained more than 26 million pounds $U_3O_8$ in such small quantity of rock that mining was completed in six months. Uranium processing now proceeds from an ore stockpile adjacent to the mill.

The owner, Queensland Mines Ltd. (QML), is a wholly-owned subsidiary of Pioneer Concrete Services, Ltd. (part of The Pioneer Group, an Australian conglomerate having annual revenues of $1.5 billion). The Nabarlek mill was designed to produce 3.3 million pounds $U_3O_8$ per year, but has frequently exceeded that rate.

QML has sold all of its future production, except for approximately 6 million pounds $U_3O_8$. QML's six long-term contracts are divided between European and Japanese utilities. At current production rates, QML adds approximately 800,000 pounds per year to its $U_3O_8$ stockpile. The company desires diversification into the US market, but has been frustrated by the Australian government's unfavorable policies. In the long term QML hopes to develop (for subsequent mining) additional resources from the 140 uranium anomalies it has discovered in the vicinity of Nabarlek.

In a politically-inspired move, the Australian government announced the suspension of uranium shipments to France as a protest against French weapons tests in the Pacific Ocean. The next shipment under the contract with Electricite de France, however, is not due until October 1984. It is the consensus in Australia that the political threat will not be carried out; to do so would carry prohibitive risks for other aspects of Australia's international trade. (Report 178)

The **Ranger** mine and milling operation is the flagship of the Australian uranium industry. Until Canada's Key Lake project reaches full capacity production, expected later this year, Ranger's annual uranium output will remain second only to that of Rossing. Ranger is owned by Energy Resources of Australia (ERA), a public company specially incorporated for this purpose (Report 150). ERA estimates that Ranger's annual capacity could be increased from 6.6 million to approximately 10 million pounds $U_3O_8$ at a cost of approximately $60 million. If so, Ranger's reserves of approximately 100,000 tonnes $U_3O_8$ (52,200 tonnes proven, 58,600 tonnes probable) would give the mine a remaining life of at least 20 years.

In order to ease consumer concern over the long

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transport distances from Australia, ERA has adopted a policy of shipping uranium ahead of schedule and storing it for the customer free of charge at nominated facilities. ERA holds sales contracts for just over 90 percent of present capacity to 1996. Currently producing in excess of its obligations, ERA is seeking US contracts under negotiating licenses issued by the present government, but is, of course, subject to the same problems facing QML.

The Company has managed its industrial relations well and enjoys the support of the unions concerned. Because of its important status as an employer and earner of export income, ERA feels assured of government support. Yet the company is somewhat anxious to see the outcome of the present policy review for two reasons.

1. Unless the government settles the administrative arrangements under the bilateral agreement with the Republic of Korea, this year's shipment under the contract with Korea Electric Power Company (KEPCO) might be frustrated.

2. The company is eager to maintain its market leaderhip, but can only do so if its current marketing efforts, mainly in the USA, are successful and find government approval (prerequisites for an expansion of capacity).

Although the total direct employment at Nabarlek and Ranger combined is less than 600, a significant part of the Northern Territory economy draws its impetus from these two producers. The local population, including the Aboriginal groups, seems to be quite solidly in favor of an expanded uranium industry in the Northern Territory. Ultimately, the government will be hard put to ignore this potential for economic growth in an otherwise underemployed region.

### Production Potential

Jabiluka near the Ranger mine and Yeelirrie in Western Australia (Figure 1) are the projects under development that are technically most advanced. **Honeymoon** in South Australia and **Lakeway** near Yeelirrie had attained "approved project" status before the government changed from Liberal to Labor in March 1983. However, in the light of the ALP platform and the government's inaction, the activities on all projects have been reduced to the minimum, with the exception of the **Olympic Dam** (Roxby Downs) project in South Australia, on which a $150 million feasibility study is proceeding.

**Jabiluka**'s development depends, quite aside from government policy, on market demand sufficient to provide a base load for development of the 200,000 tonnes $U_3O_8$ contained in the deposit. Although they plan a mill of approximately 10 million pounds annual capacity, the project partners believe that the likely starting capacity will be closer to 6.6 million pounds $U_3O_8$ per year.

Pancontinental Mining (65 percent owner) entered into a commercial understanding with the CEGB (Central Electricity Generating Board) of the UK for the delivery of approximately 4.4 million pounds $U_3O_8$ from 1988 to 1998. However, the previous Australian government (Liberal) found the pricing provisions of the proposed contract inconsistent with policy objectives and refused to approve the terms. Absent government policy supporting uranium mining, as distinct from merely tolerating it, the Jabiluka partners will find it difficult to present the project as a future supplier in the marketplace.

The **Yeelirrie** project suffered a major setback when Esso, Western Mining Company's partner in the joint venture, disengaged itself from uranium mining. Since then, WMC attempts to fill the vacancy have failed. The Yeelirrie project, like others which under the previous government had received approval to seek markets, lost its negotiating licenses when the Labor Government came to power. In the process of seeking new project partners, a WMC analysis found that the project would be viable at an annual capacity of 5.5 million pounds $U_3O_8$. If Yeelirrie were to proceed on this basis, the life of the higher-grade portion of its shallow ore body would be extended, the total capital cost reduced and the entry barrier lowered in terms of the base load tonnage required, relative to the target annual capacity of 10 million pounds $U_3O_8$ once considered. WMC has stated that without the reinstatement of its negotiating licenses, it will have no choice but to shelve the project.

The **Koongarra** deposit, originally discovered by Noranda, was acquired in 1980 by Denison. It contains approximately 13,000 tonnes $U_3O_8$. Plans exist for the production of approximately 2.5 million pounds per year. Denison encountered numerous delays in its negotiations with Aboriginal groups who hold traditional land rights over the area. In July of this year, Denison achieved a breakthrough when the Aboriginal community swung its support behind the project. The traditional owners have informed the federal government of their preference for the project to proceed. The agreement with Denison includes, in addition to the usual royalty provisions, the right of the Aboriginal community to acquire 25 percent of the project equity. The arrangements, which are kept

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confidential, may include provisions for Denison to assist the Aboriginals financially in the acquisition. In any event, Denison must divest itself of 75 percent of the equity in order to meet foreign investment guidelines. The 25 percent destined for Aboriginal equity holders represents a promising start.

Denison's move has strategic merits in that it tests the government's integrity regarding its support of this socially vulnerable minority and its rights to self-determination. The company believes that production could begin within two to three years from the time the government grants approval. Considering the political processes involved, this time frame seems somewhat optimistic, as the company still must enter into sufficient export contracts before it can finance the project and place the remaining 50 percent of the equity (by the time of production startup) in Australian hands.

The **Honeymoon** project, owned 25.5 percent by CSR, 25.5 percent by Teton Exploration Drilling Co., and 49 percent by MIM, is located in South Australia. Upon the completion of a semi-commercial pilot plant, designed to use the in-situ leach extraction technique, the state government (ALP) refused to grant the necessary mining permit. The state government based its decision on the ALP platform that calls for a moratorium on uranium projects and, *supposedly*, on environmental grounds. Even though the project had already obtained the requisite environmental clearances, South Australia's government has rejected the project owners' claim for compensation from the state.

**Beverley**, also located in South Australia, is in a similar situation. When the state government refused the operating license to Honeymoon, it also denied a pilot plant operating license for the Beverley project before the owners' joint venture company, South Australian Uranium Corporation, even applied for one. SAUC, owned 50 percent by Western Nuclear Ltd. (USA) and 50 percent by a group of three equal partners (Oilmin, Petromin, and Trans Oil), has meanwhile applied for a permit to construct a small experimental in-situ extraction facility but has received no response from the state government. SAUC has yet to complete its final environmental impact statement.

**Olympic Dam**—The Olympic Dam project joint venture partners, WMC and BP (British Petroleum, Ltd.), have agreed on the metallurgical extraction processes which the $18 million pilot plant will be testing once its construction is completed. The ore treatment process will encompass milling, flotation, acid leaching of the uranium-bearing portion and, for the production of metallic copper, also smelting. Underground evaluation is continuing at a high rate.

Upon the commencement of construction activities, local Aboriginal groups have registered their opposition, claiming that a proposed access road will encroach upon some sacred sites. They have demanded the diversion of the road and have blocked its construction by setting up camp on the alignment. According to the company, a diversion would be costly and unsound from an environmental and engineering standpoint. During two years of extensive anthropological studies, the existence of the alleged sites was not revealed. WMC, which manages the project, faces an impasse, but is confident it will find an acceptable solution.

Although no definitive production plans have been announced, preliminary estimates suggest that the project could yield 150,000 tonnes of copper and 6.6 million pounds $U_3O_8$ per year. The viability of the Olympic Dam project is more dependent on the demand for copper than on the market for uranium. However, in a co-product operation, a market for the predominant metal alone does not ensure success. Like the other Australian projects, Olympic Dam awaits clarification of the federal government position, but probably with more equanimity than the others. There is far less political controversy over Olympic Dam than any other project. It has been recognized by both state and federal governments as a significant economic stimulant. In addition, the fact that uranium is secondary to copper shields the project somewhat from criticism associated with concern about nuclear weapons. Thus, the project is unlikely to fail for lack of political acceptance.

### Union Attitudes

The unions, in accordance with the ALP policy, have officially opposed the mining and export of uranium, at least until the existence of what they regard as adequate safeguards and means of waste disposal. In practice, however, unions have sought and have obtained employment rights through the industrial courts in the uranium production centers at Nabarlek and Ranger. Unions have been orderly in fulfilling their contracts, both to produce uranium at the mines and to load it at the wharves. No production losses or delivery delays have occurred because of union action motivated by opposition to uranium mining.

Unions in Australia are diverse in character and range from local independent associations to large national or-

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ganizations. There is a preponderance of small unions: 75 percent have fewer than 5,000 members, covering only 8 percent of the nation's total union membership. This pattern is based on traditional craft unions which have contributed much to the incidence of stoppages because of inter-union jurisdictional disputes. The trade unions are organized in national confederations, of which the largest is the Australian Council of Trade Unions (ACTU). The ACTU holds an official uranium policy which is little different from that of the ALP, but its policy is not binding on individual member organizations.

Unions have discovered that in order to survive, they need highly professional and well-paid representatives, which the smaller unions cannot afford. Therefore, small unions are often forced into amalgamations. A new type of union representative is emerging, more enlightened and more compatible with the business executive. This development might very well improve labor relations throughout Australia. The uranium industry is fortunate that the majority of its workforce is associated with one of the larger unions, the leadership of which has taken a favorable attitude to uranium mining and export.

**Non-proliferation Safeguards**

The Australian policy on international safeguards was made public in 1977. It states that Australia is not willing to supply uranium to all countries with nuclear reactors. For all countries other than the five nuclear powers (weapons states) recognized by the Non-Proliferation Treaty (NPT), sales are only considered to countries which are parties to the NPT. As for the weapons states, Australia will supply only to those that give an assurance that any uranium they receive will be covered by IAEA safeguards. In addition, Australia requires the conclusion of a bilateral agreement with the country wishing to import Australian uranium. Bilateral agreements specify that Australian uranium and nuclear materials derived therefrom will be used for peaceful purposes and will not be diverted to military use. Australia has signed bilateral agreements with nine Eratom member states: Canada, Finland, France, Japan, Republic of Korea, Philippines, Sweden, the UK, and the USA. The new government has ordered a review of Australia's international safeguards arrangements in parallel with the overall policy review it is conducting. The safeguards review will assess how well the bilateral system has performed to date. The completion date for the report to the Cabinet is probably one month away.

**Conclusion**

Australia has the potential to become one of the world's largest uranium producing nations. However, lack of support from successive Liberal and Labor governments has slowed the development of new mines and mills much more than expected by the market. Yet, once committed, construction of Nabarlek and Ranger progressed rapidly. Both projects were completed on time and within budget. Commissioning and production start-up were equally successful.

Uranium shipments to date have met schedules despite initial union trouble at the Darwin wharf. Australian facilities are built to high technical standards and their operations are as efficient as any in the world. Both operating projects are financially sound and have paid dividends to their shareholders from the first year of operation. Most of their production is committed for 10 years or more. Australia has an established record of performance as an exporter of a wide range of mineral products.

The following factors are important to a consumer's assessment of Australia as a potential supplier.

1. Political events have slowed development of the country's uranium resources, particularly with respect to the growth of production capacity. The performance of the Australian government on the uranium question has generally fallen short of the degree of commitment needed for growth.
2. During the past ten years, uranium miners and government administrators have developed well-tested, cooperative ways of working together.
3. If Australia is ever to realize its potential as a uranium supplier, the development of a larger market for Australian uranium will be crucial.
4. Three examples (Mary Kathleen, Ranger and Nabarlek) have demonstrated what the Australian uranium industry can do once political obstacles are overcome.

When the Fox Commission examined the cost of delaying Australian uranium exports, it labored under a fundamental misconception which derived from an oversimplification of economic theory, the assumption that markets are always available. In practice, buyers who would have liked to diversify supply sources between 1976-80 by purchasing Australian uranium turned to other sources, probably at higher prices. African, Canadian and South African producers have increased their market share at Australia's expense.

Undoubtedly, Australia's delayed market entry reduced considerably the potential for uranium sales. Sales lost in such a fashion are not easily regained. Neither are the export revenues, the employment opportunities and

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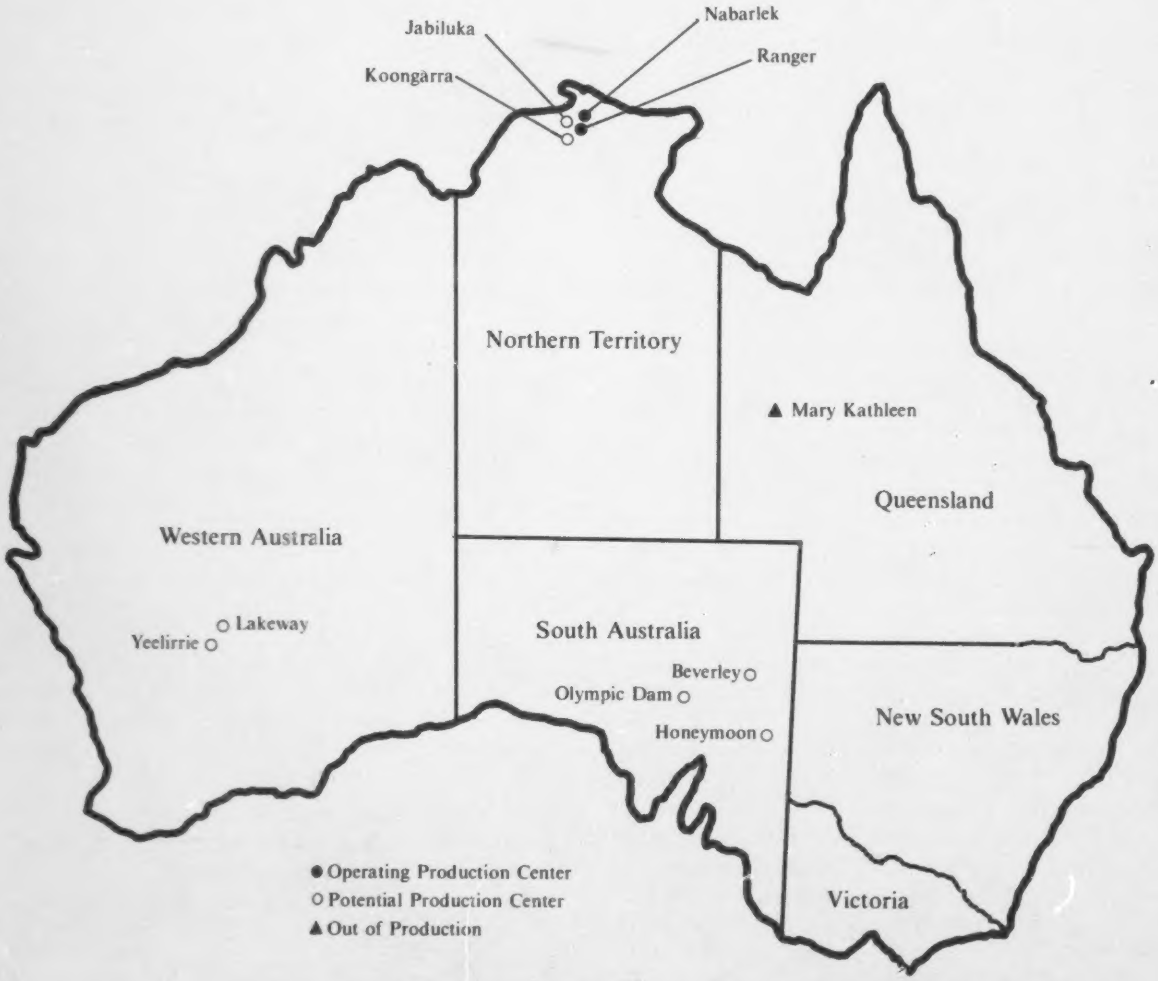
the international standing in the marketplace. One estimate placed the cost of the five-year delay at more than one billion dollars (in 1980 dollars).

Although it is futile to dwell on what might have been, there is merit in learning from the past in order to avoid costly procrastination in the future. Even the diminished market potential that may remain available to Australia during the remainder of this decade cannot be translated into sales without a serious government commitment. The industry hopes that the government will adopt a policy more favorable to uranium development and more consistent with Australia's resources and technical capabilities. With unions largely on the side of development and a solid 66 percent majority in favor of uranium mining, Australia stands a reasonable chance of outgrowing the image of a "supplier of last resort" and of becoming a significant and reliable supplier.

**Figure 1**

**Australia: Selected Uranium Projects**


Jabiluka
Nabarlek
Ranger
Koongarra
Northern Territory
▲ Mary Kathleen
Queensland
Western Australia
○ Lakeway
Yeelirrie ○
South Australia
Beverley ○
Olympic Dam ○
Honeymoon ○
New South Wales
Victoria
● Operating Production Center
○ Potential Production Center
▲ Out of Production

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## URANIUM CONSUMPTION AND PRODUCTION IN CANADA

### Introduction

Canada's nuclear power and uranium industries share a number of characteristics with those of other industrialized nations.

1. Nuclear power has not met the growth forecasts of a decade ago; nor has it turned out to be as economical as optimists predicted.
2. Ratepayers and politicians are publicly challenging existing utility supply contracts and plant construction programs on environmental as well as economic grounds.
3. Higher cost producers unable to replace cancelled or expired contracts have closed down operations completely.
4. Lower cost suppliers are competing aggressively and successfully for long-term contracts.
5. The federal government has enacted marketing policies to protect the domestic Canadian industries.

### Nuclear Power

In the early 1970s, nuclear power was viewed in eastern Canada as it was in other industrialized nations, as the principal future source of baseload electrical power. Utilities planned nuclear power plants to meet the steady growth in demand for electricity that they anticipated.

Although Canada's nuclear industry has suffered along with those of other Western nations from subsequent reductions in planned capacity, the curtailment of plans has not been as drastic as in many other countries. Figure 2 shows the locations of Canada's nuclear reactors and uranium production centers.

Two new nuclear power plants became operational in early 1983—Hydro Quebec's Gentilly Unit 2 and New Brunswick's Pt. Lepreau. While these are the only units that these utilities have planned, Ontario Hydro has eleven units under construction to supplement ten that are currently operating commercially. Table 2 lists the eleven units that are now being built and their scheduled commercial operation dates.

The combined capacity of New Brunswick and Hydro Quebec nuclear units is 1,268 MWe; adding Ontario Hydro's nuclear capacity of 4,711 MWe yields a total of 5,979 MWe for Canada's current installed nuclear generating capacity. By 1992, the 8,072 MWe now under construction will have increased Canada's total commercial capacity to 14,051 MWe. This translates to a growth in uranium consumption from 2.7 million pounds $U_3O_8$ in 1983 to approximately 4 million pounds annually by 1992. Projected uranium consumption is shown in Table 6.

### Table 2

### ONTARIO HYDRO NUCLEAR UNITS UNDER CONSTRUCTION

| Unit | MWe (net) | Commercial Operation Date |
|---|---|---|
| Bruce 5 | 750 | July 1984 |
| Bruce 6 | 750 | April 1984 |
| Bruce 7 | 750 | April 1986 |
| Bruce 8 | 750 | January 1987 |
| Pickering 6 | 516 | April 1984 |
| Pickering 7 | 516 | September 1984 |
| Pickering 8 | 516 | September 1985 |
| Darlington 1 | 881 | February 1989 |
| Darlington 2 | 881 | May 1988 |
| Darlington 3 | 881 | November 1991 |
| Darlington 4 | 881 | August 1992 |
| TOTAL | 8,072 | |

### Production

In 1982, Canada produced approximately 21 million pounds $U_3O_8$, an increase of almost 5 percent over its 1981 production of approximately 20 million pounds. Production in 1983 is expected to hold steady, with both Key Lake (Saskatchewan Mining Development Corporation (SMDC), Uranerz Canada, and Eldorado Nuclear) and the reactivated Stanleigh mine at Elliot Lake (Rio Algom, Ltd.) adding production in the second half of the year. Key Lake will produce appoximately 2 million pounds by year end; first yellowcake shipments are scheduled for November. Stanleigh, which has been reactivated since July 1, is producing at a rate of roughly 1.8 million pounds $U_3O_8$ per year.

Nuexco estimates that Canadian uranium production will grow 50 percent, from 21 million pounds $U_3O_8$ this year to approximately 32 million pounds $U_3O_8$ annually by 1987. This growth, by province, is shown in Table 3.

### Contracts

The active Canadian uranium companies are: AMOK; Denison Mines; Eldorado Nuclear; Rio Algom, Ltd.; SMDC; and Uranerz Canada. AMOK, operator and 80 percent owner of Cluff Lake, is a subsidiary of three French companies (30 percent CEA, 25 percent Compagnie de Mokta, and 45 percent Pechiney Ugine Kuhlman). AMOK is a *captive producer* in that all of the

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### Table 3

### PROJECTED CANADIAN URANIUM PRODUCTION

(millions of pounds $U_3O_8$)

| | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 |
|---|---|---|---|---|---|---|---|---|---|
| Saskatchewan | 9.0 | 12.8 | 20.0 | 19.5 | 20.0 | 20.0 | 20.0 | 20.0 | 20.0 |
| Ontario | 11.9 | 12.1 | 12.1 | 11.9 | 11.9 | 11.9 | 11.9 | 11.9 | 11.6 |
| TOTAL CANADA | 20.9 | 24.9 | 32.1 | 31.4 | 31.9 | 31.9 | 31.9 | 31.9 | 31.6 |

### Table 4

### RIO ALGOM, LTD. & DENISON MINES PUBLICLY KNOWN CONTRACTS

(thousands of pounds $U_3O_8$)

| Buyer | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 |
|---|---|---|---|---|---|---|---|---|---|
| *Denison Commitments* | | | | | | | | | |
| Ontario Hydro | 847 | 1600 | 1600 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 |
| Tokyo EPCo. (Japan) | 4230 | 3380 | 3380 | 3380 | 3380 | 3380 | 3380 | 3380 | 3380 |
| *Rio Algom Commitments* | | | | | | | | | |
| Duke Power (USA) | 1500 | 1500 | 1500 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 |
| Westinghouse (USA) | 1000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ontario Hydro | 1000 | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 | 1400 |

### Table 5

### SMDC, ELDORADO NUCLEAR & URANERZ CANADA PUBLICLY KNOWN CONTRACTS

(thousands of pounds $U_3O_8$)

| Buyer | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 |
|---|---|---|---|---|---|---|---|---|---|
| *El Dorado Nuclear Commitments* | | | | | | | | | |
| Hokuriku (Japan) | 400 | 400 | 400 | 0 | 0 | 0 | 0 | 0 | 0 |
| Public Service E&G (USA) | 175 | 175 | 175 | 175 | 175 | 175 | 175 | 175 | |
| Ontario Hydro | 0 | 0 | 528 | 528 | 528 | 528 | 616 | 616 | 61 |
| Ontario Hydro | 700 | 600 | 600 | 0 | 0 | 0 | 0 | 0 | 0 |
| *SMDC Commitments* | | | | | | | | | |
| Commonwealth Ed. (USA) | 1000 | 1000 | 1000 | 1000 | 0 | 0 | 0 | 0 | 0 |
| Kansas G&E (USA) | 0 | 0 | 0 | 0 | 200 | 200 | 200 | 200 | 200 |
| Philadelphia Electric (USA) | 0 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| SSPB (Sweden) | 325 | 325 | 325 | 325 | 325 | 325 | 325 | 325 | 0 |
| Sydkraft (Sweden) | 325 | 325 | 325 | 325 | 325 | 325 | 325 | 325 | 0 |
| Yankee Group (USA) | 0 | 0 | 200 | 400 | 400 | 400 | 400 | 400 | 400 |
| *Uranerz Canada Commitments* | | | | | | | | | |
| Florida Power (USA) | 0 | 0 | 200 | 200 | 200 | 200 | 200 | 0 | 0 |
| Ontario Hydro | 0 | 0 | 900 | 900 | 900 | 900 | 900 | 90 | 900 |
| RWE (Germany) | 0 | 0 | 0 | 900 | 900 | 900 | 900 | 900 | 900 |
| Synatom (Belgium) | 289 | 289 | 289 | 289 | 289 | 289 | 289 | 289 | 289 |

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company's uranium production is dedicated to two customers.

Rio Algom's Stanleigh mine is also a captive producer; its output is dedicated to Ontario Hydro. Rio Algom production from its Panel and Quirke mills is committed to utilities in the USA, UK, Japan, Germany, and Canada. Denison Mines supplies a Japanese utility and Ontario Hydro.

A summary of Rio Algom and Denison publicly known supply contracts is shown in Table 4. Annual amounts are estimates based on published sources.

The three sellers aggressively seeking uranium supply contracts are the Key Lake Mining Company (KLMC) partners: SMDC, Uranerz Canada, and Eldorado Nuclear. In addition to Key Lake uranium, SMDC seeks buyers for material it will receive from AMOK as its 20 percent share of Cluff Lake output, and El Dorado for its Rabbit Lake/Collins Bay output. A summary of the publicly known supply contracts completed by these three companies is shown in Table 5. Annual amounts are estimates based on published sources.

**Government Policies**

In the early to mid-1970s, various Canadian government policies and guidelines were adopted in anticipation of future Canadian uranium and nuclear industry needs. They included the following provisions.

1. A designated percentage of resources is to be reserved for Canadian domestic use.

2. Export contracts are to be written for no longer than ten years; five year extensions are to be allowed, subject to "recall".

3. Contracts for export of uranium are required to have provisions for an escalating floor price and annual price negotiations.

4. Exported uranium is to be in the form of natural $UF_6$ rather than $U_3O_8$ as long as Canadian conversion capacity is available and generally competitive.

The government is now reviewing these policies and is expected to revise them by the end of this year. Presumably, the revision will take into account changes that have taken place in the market since the policies were established. For example, the well-publicized uranium supply excesses expected in the 1990s by Ontario Hydro, together with the enormous Saskatchewan finds, render unnecessary the policy of holding a specific percentage of uranium as reserves for Canadian usage. The lifting of this policy would allow more uranium to be contracted for export well into the next decade. Furthermore, the prospect, however remote, that material previously committed might be "recalled" could make Canadian producers seem unreliable to potential foreign customers.

The uranium upgrading requirement is currently the most controversial of the Canadian government's uranium export policies. In 1981 a US utility spokesman was quoted as saying that the domestic conversion requirement "really gets down to price" and is "not so bothersome if the price of conversion is good." However, the upgrading requirement may still prove counter-productive because many potential customers are committed to long-term conversion contracts outside of Canada.

The market will be the judge of the success of the present enforcement of Canada's uranium upgrading policy. As in the past, US buyers will find a way to handle their unwanted conversion contracts if Canadian yellowcake and conversion prices are the best available. Otherwise, the Canadian government may choose to accommodate the market much as it did in 1982, when it allowed specific contracts to be finalized without the upgrading requirement.

**Conclusion**

Beginning in 1985, Canadian producers will have available for sale an approximate annual average of up to ten million pounds equivalent $U_3O_8$ per year. That figure is derived from the analysis shown in Table 6. The analysis subtracts Nuexco's estimates of Canadian exports currently under contract and domestic uranium consumption from Nuexco's forecast of Canadian uranium production. The result, designated in Table 6 as the balance, is equivalent to the algebraic sum of annual uncommitted production and annual change in inventory. For example, Table 6 indicates a balance of 12.9 million pounds $U_3O_8$ in 1991; if 5 million pounds were already committed to scheduled increases in domestic utility inventories, 1991 uncommitted production would be 7.9 million pounds. That would not mean that, in 1991, Canadian producers would be offering 7.9 million pounds for delivery. Rather, it woud mean that at various times in the next eight years Canadian producers would be offering for sale a total of 7.9 million pounds for *delivery* in 1991 (assuming producers wished to hold no material in inventory). Canadian production is largely committed for 1983 and 1984.

The balance figure derived in Table 6 for 1983 is *minus* 1.7. A negative result for the balance figure implies that a portion of exports or consumption will be supplied from inventory. In this case, Nuexco's estimate of Canada's 1983 beginning inventory is approximately 6 million pounds $U_3O_8$ equivalent, so without additional sales for 1983 delivery, approximately 4 million pounds will re-

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## Table 6

## CANADA: URANIUM CONSUMPTION AND PRODUCTION BALANCE

**(Millions of Pounds $U_3O_8$)**

| | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 |
|---|---|---|---|---|---|---|---|---|---|
| PRODUCTION[1] | 20.9 | 24.9 | 32.1 | 31.4 | 31.9 | 31.9 | 31.9 | 31.9 | 31.6 |
| less CONSUMPTION[2] | 2.8 | 31. | 3.0 | 3.3 | 3.5 | 3.8 | 3.5 | 4.1 | 4.0 |
| less EXPORTSD[3] | 19.8 | 18.6 | 19.1 | 18.5 | 17.0 | 17.0 | 17.1 | 16.7 | 14.7 |
| equals BALANCE[4] | (1.7) | 3.2 | 1.0 | 9.6 | 11.4 | 11.1 | 11.3 | 11.1 | 12.9 |

[1] This Report, Table 2.

[2] Nuexco estimate of contracts already in place.

[3] Nuexco estimate.

[4] The algebraic sum of annual uncommitted production and annual change in inventory.

main in inventory as of the beginning of 1984. The derived balance for 1984 is 3.2 million pounds equivalent $U_3O_8$. The cumulative sum of the annual balance figures derived in Table 6 amounts to almost 80 million pounds $U_3O_8$ equivalent. In Nuexco's opinion, the resolution of a supply overhang of that magnitude will require a combination of the following mechanisms:

1. Additional export sales, either from presently uncommitted production or from future accumulations of utility inventory;
2. Utility inventory increases beyond those already scheduled under current contracts;
3. Production cutbacks or shutdowns.

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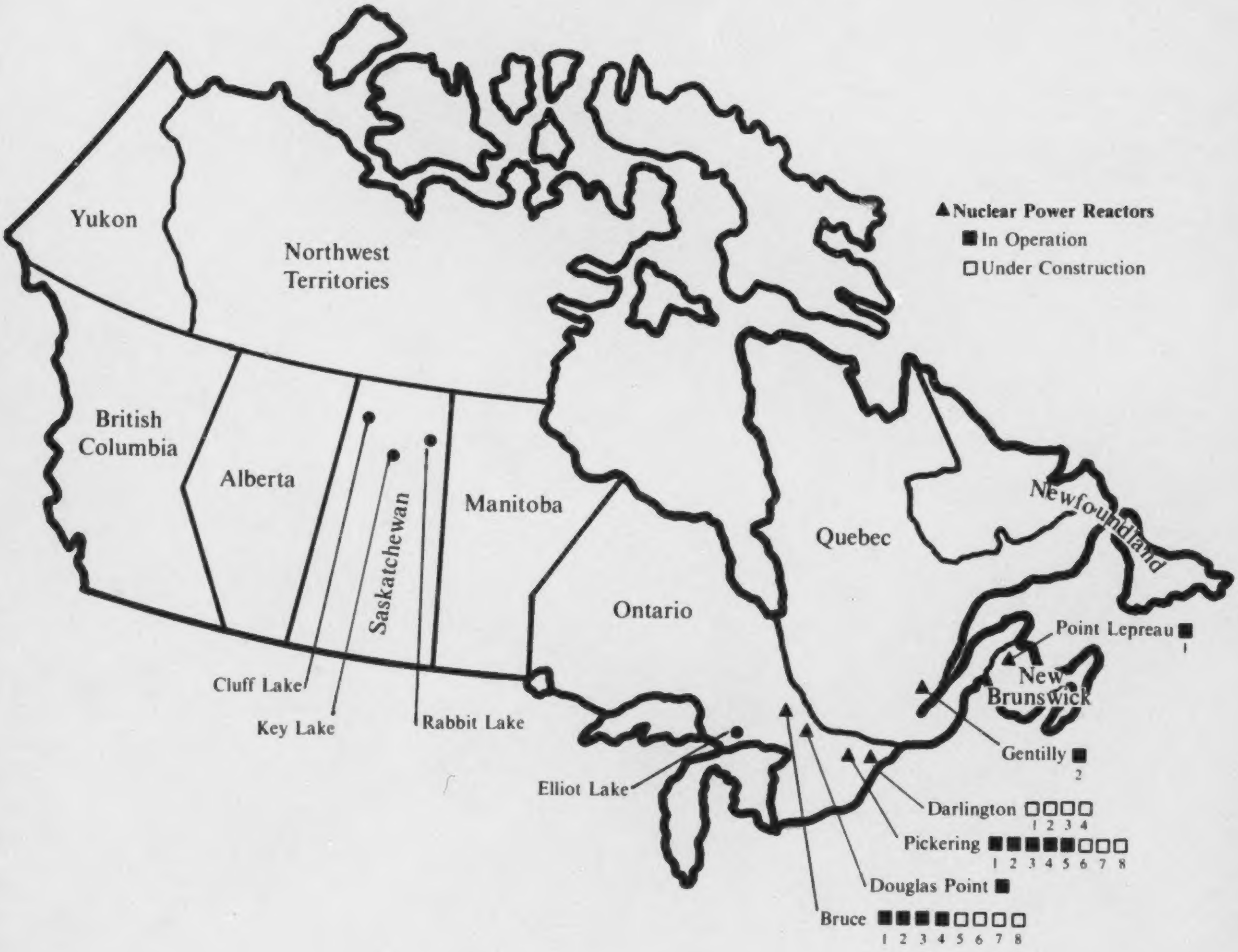
**Figure 2**

**Canada: Reactors and Production Centers**


▲Nuclear Power Reactors
■ In Operation
□ Under Construction
Yukon
Northwest Territories
British Columbia
Alberta
Saskatchewan
Manitoba
Ontario
Quebec
Newfoundland
New Brunswick
Cluff Lake
Key Lake
Rabbit Lake
Elliot Lake
Point Lepreau ■ 1
Gentilly ■ 2
Darlington □□□□ 1 2 3 4
Pickering ■■■■■□□□ 1 2 3 4 5 6 7 8
Douglas Point ■
Bruce ■■■■□□□□ 1 2 3 4 5 6 7 8

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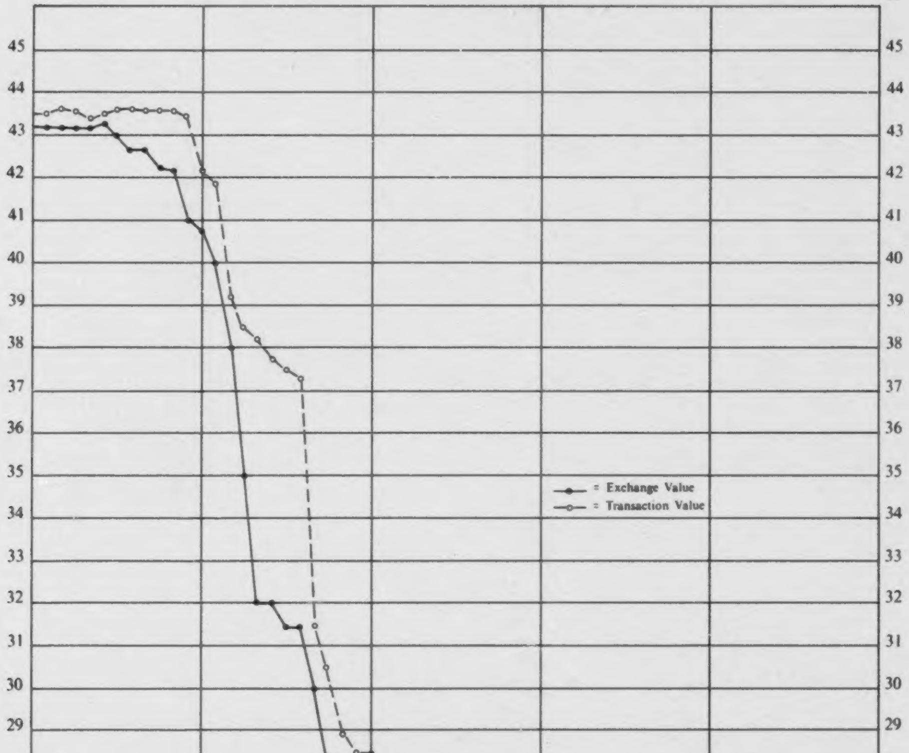
*HISTORICAL MARKET DATA*

## EXCHANGE AND TRANSACTION VALUES SINCE JANUARY 1979

Determined as of the last day of the month indicated



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*HISTORICAL MARKET DATA*

## HISTORICAL EXCHANGE VALUES

Determined as of the last day of the month indicated (US Dollars/lb. $U_3O_8$)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1968 | — | — | — | — | — | — | — | 6.35 | 6.35 | 6.40 | 6.45 | 6.50 |
| 1969 | — | 6.35 | 6.10 | 6.10 | 6.25 | 6.25 | 6.20 | 6.20 | 6.15 | 6.15 | 6.15 | 6.20 |
| 1970 | 6.30 | 6.30 | 6.30 | 6.30 | 6.30 | 6.30 | 6.30 | 6.20 | 6.15 | 6.15 | 6.15 | 6.15 |
| 1971 | 6.20 | 6.20 | 6.20 | 6.20 | 6.15 | 6.05 | 6.00 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 |
| 1972 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 |
| 1973 | 5.95 | 6.00 | 6.10 | 6.20 | 6.45 | 6.50 | 6.50 | 6.50 | 6.50 | 6.50 | 6.75 | 7.00 |
| 1974 | 7.70 | 7.90 | 8.00 | 9.00 | 9.50 | 10.50 | 11.50 | 12.00 | 12.50 | 14.00 | 14.75 | 15.00 |
| 1975 | 16.00 | 16.00 | 18.00 | 20.00 | 21.00 | 23.00 | 24.70 | 26.00 | 26.00 | 28.50 | 30.00 | 35.00 |
| 1976 | 35.20 | 37.00 | 39.25 | 40.00 | 40.00 | 40.00 | 40.00 | 40.40 | 41.00 | 41.00 | 41.50 | 41.00 |
| 1977 | 41.35 | 41.50 | 41.60 | 41.60 | 42.00 | 42.25 | 42.25 | 42.25 | 42.40 | 42.75 | 43.20 | 43.20 |
| 1978 | 42.90 | 43.25 | 43.25 | 43.25 | 43.40 | 43.40 | 43.40 | 43.10 | 43.25 | 43.00 | 43.25 | 43.25 |
| 1979 | 43.25 | 43.25 | 43.25 | 43.25 | 43.25 | 43.00 | 42.70 | 42.70 | 42.20 | 42.20 | 41.00 | 40.75 |
| 1980 | 40.00 | 38.00 | 35.00 | 32.00 | 32.00 | 31.50 | 31.50 | 30.00 | 28.50 | 28.00 | 28.00 | 27.00 |
| 1981 | 25.00 | 25.00 | 25.00 | 25.00 | 25.00 | 24.25 | 23.50 | 23.50 | 23.50 | 23.50 | 23.50 | 23.50 |
| 1982 | 23.00 | 23.00 | 22.50 | 20.75 | 20.50 | 19.25 | 18.25 | 17.00 | 17.00 | 17.50 | 19.75 | 20.25 |
| 1983 | 21.50 | 21.75 | 22.25 | 23.25 | 23.50 | 23.50 | 24.00 | **24.00** | | | | |

## HISTORICAL TRANSACTION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. $U_3O_8$)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1976 | — | — | — | — | 39.60 | 39.70 | 39.70 | 40.40 | 40.30 | 40.60 | 40.70 | 40.70 |
| 1977 | 41.30 | 41.30 | 41.40 | 41.50 | 42.80 | 42.90 | 43.00 | 42.60 | 42.50 | 42.80 | 42.90 | 42.90 |
| 1978 | 43.10 | 43.30 | 43.70 | 43.60 | 43.60 | 43.20 | 43.30 | 43.40 | 43.40 | 43.60 | 43.40 | 43.70 |
| 1979 | 43.60 | 43.80 | 43.70 | 43.40 | 43.60 | 43.70 | 43.70 | 43.60 | 43.60 | 43.60 | 43.50 | 42.30 |
| 1980 | 42.00 | 39.30 | 38.60 | 38.40 | 37.90 | 37.60 | 37.30 | 31.60 | 30.60 | 29.00 | 28.70 | 27.70 |
| 1981 | 27.20 | 27.20 | 27.00 | 25.70 | 25.70 | 24.50 | 24.40 | 24.30 | 23.90 | 24.10 | 24.10 | 24.00 |
| 1982 | 24.00 | 23.70 | 23.40 | 22.60 | 22.70 | 21.50 | 20.30 | 19.10 | 17.30 | 17.00 | 17.55 | 18.80 |
| 1983 | 19.35 | 20.00 | 21.35 | 21.40 | 22.35 | 22.45 | 23.50 | **23.60** | | | | |

## HISTORICAL CONVERSION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. $U_6$)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1981 | 1.20 | 1.20 | 1.20 | 1.40 | 1.15 | 1.15 | 1.15 | 1.10 | 1.10 | 1.10 | 1.20 | 1.20 |
| 1982 | 1.20 | 1.20 | 1.20 | 1.20 | 1.00 | 1.00 | 1.00 | 0.90 | 1.10 | 1.60 | 1.45 | 1.45 |
| 1983 | 1.20 | 1.40 | 1.40 | 1.20 | 1.20 | 1.20 | 1.10 | **1.10** | | | | |

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## AUSTRALIA

| | Price Index of Materials Used in Manufacturing Industry—All Groups (Year 1968-69 = 100.0)[1] | Award Rates of Pay Indexes Australia—Adult Males In Mining Wage Earners, Weekly Rates (Year 1976 = 100.0)[2] |
|---|---|---|
| Annual Avg. 1972[3] | 105.6 | 71.26 |
| Annual Avg. 1973[3] | 124.4 | 78.96 |
| Annual Avg. 1974[3] | 141.9 | 108.07 |
| Annual Avg. 1975[3] | 150.4 | 132.55 |
| Annual Avg. 1976[3] | 168.4 | 160.93 |
| Annual Avg. 1977[3] | 192.0 | 179.03 |
| Annual Avg. 1978[3] | 198.5 | 190.04 |
| Annual Avg. 1979 | 248.8 | 196.34 |
| Annual Avg. 1980 | 321.8 | 218.00 |
| Annual Avg. 1981 | 355.3 | 237.34 |
| Annual Avg. 1982 | 368.5R | 174.88 |
| Apr 1982 | 367.7 | 171.4[2] |
| May 1982 | 367.6 | 171.9 |
| Jun 1982 | 367.8 | 173.2 |
| Jul 1982 | 370.0 | 177.2 |
| Aug 1982 | 375.5R | 178.2 |
| Sep 1982 | 375.2R | 178.4 |
| Oct 1982 | 378.4R | 178.4 |
| Nov 1982 | 375.8R | 178.5 |
| Dec 1982 | 375.0R | 179.5 |
| Jan 1983 | 386.9R | 179.6R |
| Feb 1983 | 388.6R | 179.5R |
| Mar 1983 | 398.7R | 179.4R |
| Apr 1983 | 410.2R | 179.7R |
| May 1983 | 417.1P | 179.8P |
| Jun 1983 | — | 179.9P |

P = Preliminary R = Revised since last month

[1] Australian Bureau of Statistics, Canberra: "Price Index of Materials Used in Manufacturing Industry" (Catalogue No. 6411.0), Table 3.

[2] Australian Bureau of Statistics, Canberra: "Award Rates of Pay Indexes, Australia" (Catalogue No. 6312.0), Table 8. Figures are being converted to an Index number. As the data are converted, the new index numbers will be inserted. Figures for the latest fourteen months shown are subject to revision.

[3] Monthly data for 1970 through 1978 appear on pages 4.7 and 4.8 of Nuexco Report 138.

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## *GOVERNMENT STATISTICS*

### CANADA

| | Industry Selling Price Index: Manufacturing (D 500000)[1] [2] (1971 = 100.0) | Wage-earner Data: Average Hourly Earnings (C$)[4] [5] | | | | |
|---|---|---|---|---|---|---|
| | | Metal Mining, including Milling (SIC 050-099)[3] | | Primary Metal Industries, non-ferrous (SIC 296-298)[6] | | Chemicals and Chemical Products (SIC 372-379)[7] |
| | | | (SIC 296) | | (SIC 298) | |
| Annual Avg. 1979 | 217.9 | 9.66 | — | 7.35 | — | 7.67 |
| Annual Avg. 1980 | 247.2 | 10.80 | — | 8.05 | — | 8.50 |
| Annual Avg. 1981 | 288.7 | 12.23 | — | 9.03 | — | 9.53 |
| Annual Avg. 1982 | 288.8 | 13.92 | — | 9.98 | — | 10.63 |
| May 1982 | 288.8 | 13.86 | — | 9.88 | — | 10.62 |
| Jun 1982 | 289.7 | 13.83 | — | 9.92 | — | 10.69 |
| Jul 1982 | 290.3 | 14.02 | — | 10.05 | — | 10.73 |
| Aug 1982 | 290.3 | 14.23 | — | 10.03 | — | 10.80 |
| Sep 1982 | 292.4 | 14.01 | — | 10.18 | — | 10.73 |
| Oct 1982 | 292.1 | 13.89 | — | 10.18 | — | 10.86 |
| Nov 1982 | 291.3 | 14.28 | — | 10.43 | — | 10.90 |
| Dec 1982 | 292.3 | 14.32 | — | 10.55 | — | 11.06 |
| Jan 1983 | 293.5 | 14.35 | — | 10.72 | — | 11.06 |
| Feb 1983 | 293.5R | 14.28 | — | 10.74 | — | 11.06 |
| Mar 1983 | 295.2 | 14.48 | — | 10.93 | — | 11.21 |
| Apr 1983 | 297.1 | 14.13R | 11.57R | — | 10.10R | 10.97R |
| May 1983 | 298.5R | 14.14 | 11.39 | — | 9.82 | 11.10P |
| Jun 1983 | 299.6R | 13.77P | 11.26P | — | 9.67P | — |
| Jul 1983 | 300.8P | — | — | — | — | — |

P = Preliminary R = Revised since last month

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[1] Statistics Canada, Prices Division, Ottawa: "Industry Price Indexes" (Catalogue 62-011), Table 1. Indexes for the most recent six months shown are subject to revision.

[2] Monthly data for 1973 through 1978 appear on page 4.10 of Nuexco Report 138.

[3] The wage earner series in Nuexco reports prior to March 1983 was Metals (SIC 050-059).

[4] Statistics Canada, Labour Division, Employment and Payrolls Section, Ottawa: "Employment, Earnings and Hours" (Catalogue 72-002), Table 2.

[5] Monthly data for 1977 and 1978 appear on page 4.11 of Nuexco Report 138.

[6] Beginning with the April 1983 figure, Primary Metal Industries, non-ferrous is split into SIC 296 and SIC 298.

[7] Chemical and Chemical Products prior to April 1983 was SIC 370-379. The new series is from a new survey which includes all companies and is based on a 1970 classification. The old survey included companies of 20 employees or more.

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## REPUBLIC OF SOUTH AFRICA

| | Average Declared Working Costs per Metric Ton of Gold Ore Milled (Rand)[1] | Consumer Price Index[2] (1975 = 100, except where otherwise indicated) | Producer[5] Price Index All Groups (1975 = 100) | Total Employment in Mining and Quarrying (Code 35)[7] | Total Salaries and Wages in Mining and Quarrying (1,000 Rand) (Code 40)[7] |
|---|---|---|---|---|---|
| Annual Avg. 1972[3] | 8.79 | 113.3[4] | 63.9 | 623,067 | 443,933 |
| Annual Avg. 1973[3] | 10.51 | 124.1[4] | 72.3 | 684,743 | 572,133 |
| Annual Avg. 1974[3] | 13.18 | 138.5[4] | 85.3 | 674,140 | 761,596 |
| Annual Avg. 1975[3] | 16.71 | 157.2[4] | 100.0 | 639,473 | 1,003,617 |
| Annual Avg. 1976[3] | 19.30 | 174.7[4] | 115.1 | 671,240 | 1,212,983 |
| Annual Avg. 1977[3][6] | 23.87 | 194.4[4] | 130.0 | 712,006 | 1,420,670 |
| Annual Avg. 1978[3][6] | 27.14 | 137.2 | 142.7 | 664,571 | 1,537,169 |
| Annual Avg. 1979[3][6] | 30.18 | 155.3 | 164.5 | 692,209 | 1,830,632 |
| Annual Avg. 1980[6] | 35.53 | 176.7 | 192.1 | 714,379 | 2,279,615 |
| Annual Avg. 1981 | 41.89 | 206.5 | 218.3 | 728,506 | 2,820,505 |
| Annual Avg. 1982 | 47.25 | 233.5 | 248.7 | 707,552 | 3,246,071 |
| Feb 1982 | — | 220.2 | 236.8 | 705,992 | 250,191 |
| Mar 1982 | 45.49 | 225.2 | 237.4 | 725,700 | 262,210 |
| Apr 1982 | — | 228.9 | 241.9 | 707,502 | 252,562 |
| May 1982 | — | 230.3 | 244.8 | 715,162 | 258,770 |
| Jun 1982 | 45.77 | 232.1 | 246.7 | 707,552 | 261,361 |
| Jul 1982 | — | 234.1 | 249.4 | 702,141 | 283,248 |
| Aug 1982 | — | 236.8 | 253.4 | 705,562 | 276,730 |
| Sep 1982 | 48.04 | 241.0 | 255.0 | 704,344 | 282,782 |
| Oct 1982 | — | 243.9 | 260.1 | 701,316 | 285,328 |
| Nov 1982 | — | 245.4 | 262.5 | 707,966 | 287,699 |
| Dec 1982 | 49.62 | 246.2 | 263.0 | 683,982 | 288,019 |
| Jan 1983 | — | 249.0 | 264.9 | 688,030 | 289,075 |
| Feb 1983 | — | 253.1 | 267.4 | 697,089 | 281,413 |
| Mar 1983 | 50.35 | 255.9 | 269.1 | 695,976 | 290,586 |
| Apr 1983 | — | 257.8 | 270.9 | 697,158 | 286,708 |
| May 1983 | — | 259.7 | 274.1R | 701,712 | 295,701 |
| Jun 1983 | 50.51 | 260.8 | 273.1 | — | — |
| Jul 1983 | — | 262.5 | — | — | — |

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[1] Chamber of Mines of South Africa, Johannesburg; "Analysis of Working Results," published quarterly. The tonnage-weight index of average working costs per metric ton of gold ore milled for 1983 is as follows. (Base: March quarter 1982 = 100). See Nuexco report #178 page 24 for the tonnage-weighted index for 1982. Description and calculation of the index is on page 16 of Nuexco report #178.

| | | |
|---|---|---|
| 1983: | January-March | 111.2 |
| | April-June | 111.9 |

[2] Republic of South Africa Department of Statistics, Pretoria; "Government Gazette: Consumer Price Index for Urban Areas."

[3] Historical data for the Average Declared Working Costs and Consumer Price Index 1970-1979 appear on page 4.9 of Nuexco Report 140.

[4] April 1970 = 100.00.

[5] Previously known as the WHOLESALE PRICE INDEX, now the PRODUCER PRICE INDEX. The computation remains the same.

[6] Historical data for Codes 35 and 40 1977-1980 appear on page 28 of Nuexco Report 157.

[7] Bulletin of Statistics, Department of Statistics, Pretoria.

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*GOVERNMENT STATISTICS*

## UNITED STATES

| | Producer Price Index— Industrial Commodities (1967 = 100)[1] | Producer Price Index— All Commodities (1967 = 100)[1] | Consumer Price Index (1967 = 100)[2] | GNP Implicit Price Deflator (1972 = 100)[3] | Gross Average Hourly Earnings of Production or Non-supervisory Workers (US$)[4] | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Metal Mining (SIC 10) | Primary Non-ferrous Metals (SIC 333) | Chemicals and Allied Products (SIC 28) | Electric and Electronic Equipment (SIC 36) |
| Annual Avg. 1972[5] | 117.9 | 119.1 | 125.3 | 100.00 | 4.56 | 4.59 | 4.26 | 3.71 |
| Annual Avg. 1973[5] | 125.9 | 134.7 | 133.1 | 105.75 | 4.84 | 4.98 | 4.51 | 3.91 |
| Annual Avg. 1974[5] | 153.8 | 160.1 | 147.7 | 115.08 | 5.44 | 5.63 | 4.88 | 4.21 |
| Annual Avg. 1975[5] | 171.5 | 174.9 | 161.2 | 125.79 | 6.13 | 6.24 | 5.39 | 4.64 |
| Annual Avg. 1976[5] | 182.4 | 183.0 | 170.5 | 132.34 | 6.76 | 6.87 | 5.91 | 4.96 |
| Annual Avg. 1977[5] | 195.1 | 194.2 | 181.5 | 140.05 | 7.28 | 7.67 | 6.43 | 5.39 |
| Annual Avg. 1978[5] | 209.4 | 209.3 | 195.4 | 150.42 | 8.23 | 8.56 | 7.02 | 5.82 |
| Annual Avg. 1979[5] | 236.5 | 235.6 | 217.4 | 163.42 | 9.27 | 9.50 | 7.60 | 6.32 |
| Annual Avg. 1980[5] | 274.8 | 268.8 | 246.8 | 178.64 | 10.26 | 10.63 | 8.30 | 6.94 |
| Annual Avg. 1981 | 304.1 | 293.4 | 272.4 | 195.51 | 11.55 | 11.98 | 9.12 | 7.62 |
| Annual Avg. 1982 | 312.3 | 299.3 | 289.1 | 207.15 | 12.33 | 12.94 | 9.96 | 8.21 |
| Jul 1982 | 312.8 | 300.4 | 292.2 | — | 12.23 | 12.94 | 10.00 | 8.23 |
| Aug 1982 | 313.2 | 300.2 | 292.8 | — | 12.29 | 13.01 | 10.01 | 8.30 |
| Sep 1982 | 312.7 | 299.3 | 293.3 | 208.51 | 12.53 | 13.51 | 10.19 | 8.37 |
| Oct 1982 | 314.3 | 299.8 | 294.1 | — | 12.51 | 13.26 | 10.22 | 8.41 |
| Nov 1982 | 315.0 | 300.3 | 293.6 | — | 12.53 | 13.22 | 10.26 | 8.45 |
| Dec 1982 | 315.2 | 300.7 | 292.4 | 210.00R | 12.53 | 13.05 | 10.32 | 8.51 |
| Jan 1983 | 313.9 | 299.9 | 293.1 | — | 12.63 | 13.33 | 10.34 | 8.53 |
| Feb 1983 | 313.9 | 300.9 | 293.2 | — | 12.66 | 13.29 | 10.41 | 8.56 |
| Mar 1983 | 313.5R | 300.6R | 293.4 | 212.83 | 12.48 | 13.35 | 10.39 | 8.60 |
| Apr 1983 | 312.6P | 300.8P | 295.5 | — | 12.67 | 13.34 | 10.43 | 8.60 |
| May 1983 | 313.8P | 301.7P | 297.1 | — | 12.55R | 13.62R | 10.50 | 8.60R |
| Jun 1983 | 315.4P | 302.5P | 298.1 | 214.66R | 12.62P | 13.43P | 10.51R | 8.64P |
| Jul 1983 | 316.6P | 303.2P | 299.3P | — | — | — | 10.57P | 8.66P |

P = Preliminary        R = Revised since last month

[1] US Bureau of Labor Statistics, Washington, D.C.; "Producer Prices and Price Indexes," Table 6 (formerly "Wholesale Prices and Price Indexes"). Producer Price Indexes are revised four months after they are first released to reflect the availability of late reports and corrections by respondents.

[2] US Bureau of Labor Statistics, Washington, D.C.; Consumer Price Index for All Urban Consumers, US City Average, All Items.

[3] US Department of Commerce, Washington, D.C.; Bureau of Economic Analysis, National Income and Wealth Division; "Survey of Current Business," Table 7.1. The GNP Implicit Price Deflator is published quarterly, and seasonally adjusted.

[4] US Bureau of Labor Statistics, Washington, D.C.; "Employment and Earnings," Table C-2. All data based on 1972 revision of SIC Manual. Data for 1970-1976 are adjusted to the March 1977 benchmark. Data for 1977-1978 are adjusted to the March 1979 benchmark. Data for January 1979 and beyond are adjusted to the March 1980 benchmark.

[5] Monthly data 1970-1978 for Producer Price Index-Industrial Commodities, Consumer Price Index, and Employment and Earnings SIC codes 10, 333, and 28, and quarterly data for GNP Implicit Price Deflator appear on pages 4.6-4.8 of Nuexco Report 139.
Monthly data 1977-1978 for Employment and Earnings SIC Codes 10, 333, and 28 appear on page 33 of Nuexco Report 147.
Monthly data 1970-1978 for Employment and Earnings SIC Code 36 appear on page 23 of Nuexco Report 154.
Monthly data 1979-1980 for Employment and Earnings, Revised Establishment Data, all listed codes, appear on page 22 of Nuexco Report 158.
Monthly data 1977-1980 for Producer Price Index-All Commodities, appear on page 21 of Nuexco Report 158.

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# THE NUCLEAR FUEL CYCLE: DESPERATELY IN NEED OF A FRONT-END ALIGNMENT

By

**M. J. Reaves**
Vice President
Nuexco

Presented To:

**18th Intersociety Energy Conversion Engineering Conference**
Orlando, Florida
August 21-26, 1983

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# THE NUCLEAR FUEL CYCLE: DESPERATELY IN NEED OF A FRONT-END ALIGNMENT

By: M. J. Reaves
Vice President
Nuexco

The front end of the nuclear fuel cycle (about which I'm speaking today) consists of uranium supply, conversion of $U_3O_8$ to $UF_6$, enrichment of $UF_6$ and fuel fabrication. Basically, a commodity and three services. Uranium (the commodity), conversion and enrichment services are all bought and sold as though they were commodities. Thus far fuel fabrication is not resold, although some day it may be.

Our company (Nuexco) is involved in the brokerage of these front end cycle components—uranium, conversion, and enrichment. Our business activities fall into three major categories:

1. We are publishers. We have put out a monthly report on the nuclear fuel industry since 1968. This report comments on supply and demand, recent transactions, and price trends. It includes the Nuexco Exchange Value which is generally viewed as being the spot market price for uranium. We also publish values for the secondary markets for conversion and enrichment.

2. We are consultants. We develop analysis and studies on supply and demand, prices, procurement, marketing and inventory strategies as well as assorted other topics. We work on both a custom and multi-client basis.

3. Finally, and primarily, we are brokers of fuel cycle materials and services. We are the largest nuclear fuel broker in the world, having participated in transactions involving more than 200 million pounds $U_3O_8$ and millions of Kgs. of conversion and enrichment services.

Nuexco is a worldwide organization. Our headquarters are in Menlo Park, California, and we have offices in Stamford, Connecticut, in Atlanta, Georgia, and in Ferney-Voltaire, France (just outside Geneva). We also retain a complex of representatives and special consultants to provide coverage in all uranium producing and consuming areas, including Australia, Korea, Japan, Taiwan, South Africa, Niger and Gabon. The title of this paper suggests that the front end of the fuel cycle is a mess, and indeed it is. There is a glut of everything, and secondary markets have developed in all three areas.

I'll take them one at a time starting with uranium. All numbers which follow exclude Communist areas.

**Uranium**

Uranium mines and mills currently in place around the world have the capacity to turn out approximately 150 million pounds $U_3O_8$ annually. This figure will increase by 12 million pounds with the mid-1983 commissioning of the Key Lake mill in Saskatchewan (really any minute).

Actual world wide uranium production during 1982 was only 106 million pounds, most of which was produced to meet delivery obligations under contracts executed in prior years. Actual uranium consumption during 1982, however, was only 63 million pounds and will not approach 100 million pounds until 1987 or 1988 at the earliest.

So, we have an industry capable of making 150 million pounds, which is actually making 106 million pounds when only 63 million pounds were actually needed. The difference between production and consumption (some 43 million pounds) is being added to inventory, bringing total inventory to more than 400 million pounds, or equivalent to nearly 6 years forward usage. Someone, somewhere is holding that inventory with all the attendant carrying charges. Compare this with 90-day inventories of oil or 120 day coal stockpiles.

Overcapacity and overproduction when combined with numerous cancellations and deferrals of nuclear units have had predictable results. Utilities (the users) became sellers of excess or unneeded inventories, in competition with primary producers. Prices broke, declining from $40 per pound $U_3O_8$ in early 1980 to a low of $17 by mid-1982 before recovering somewhat to $24.00 today.

While spot prices have strengthened recently, they are still well below the levels necessary to justify new production ventures, and it seems likely that, rather than large new ventures, the first beneficiaries of any sustained price recovery will be production operations that had previously been shut down. But any sustainable price recovery will have to wait for the completion of the liquidation and redistribution of excess inventories.

**Conversion**

Turning next to $UF_6$ conversion, we see a somewhat similar situation. There are five major converters in the world: Kerr-McGee and Allied in the United States, Eldorado in Canada, BNFL in England and Comurhex in France. Combined they currently have the annual capacity to convert nearly 120 million pounds of $U_3O_8$ to $UF_6$. By 1985, as a consequence of almost completed expansions, this capacity will be in excess of 140 million pounds $U_3O_8$ annually. However, as noted earlier, the need in 1982 was only for 63 million pounds. The cancellations and deferrals of nuclear plants which led to the liquidation of uranium inventory have also impacted dramatically on the conversion market. Much of the

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excess uranium inventory which is for sale is in the form of $UF_6$. However, most buyers have already contracted for Conversion and therefore prefer to purchase $U_3O_8$. A transaction called the deconversion swap was developed. $UF_6$ is swapped for $U_3O_8$ plus dollars, with the dollars representing the value of the conversion service. This market is characterized by few buyers and many sellers. Not surprisingly, secondary market conversion prices have been driven down to levels well below prices charged by primary convertors. During the past year, the secondary market conversion price has fluctuated between $1.00 and $1.50 per pound U. This compares to about $3 per pound U available from primary producers.

**Enrichment**

Finally, there is the enrichment area. Here the principal suppliers number only three: U.S. DOE, the tripartite English-Dutch-German Urenco project and the multinational, French-led Eurodif project. The USSR does sell some SWU into the Western market and development projects in Brazil, South Africa and Japan provide small quantities, but the total quantity from these other sources is not really significant. The principal suppliers have the current capability, at a 0.20 tails assay and 3.0 percent assay, to enrich 130 million pounds $U_3O_8$. Again, we see supply capability nearly twice current consumption rates. And again we have seen the development of a secondary market to dispose of excess enrichment. Prices are discounted as much as 30 percent from those charged by primary suppliers.

How did this sorry state of affairs that I've described come to pass? It certainly wasn't intentional. Rather it was the result of a complex of economic, political, technical and social factors. Permitting myself perfect hindsight, it is clear that the nuclear option was oversold. Nuclear power is neither as cheap, nor as simple as was promised. Nor was the public reaction to nuclear properly gauged. On the other hand, the nuclear fathers were aware of Murphy's law. They knew nothing is as easy as it looks. They knew that if something could go wrong it would go wrong and at the worst possible time. Reactors are designed that way. But, no reasonable person would have guessed that construction times would treble from 4 to 12 years, and that actual costs would increase by up to 600 percent.

The starting point of this buildup is an unrealistic level of nuclear ordering worldwide in the late 1960s and the early 1970s. At this point, it is important to remember that utilities are unique business organizations. They are regulated monopolies. Their charter is to provide reliable service at the lowest possible rates. When nuclear appeared the cheapest, it was ordered.

As more and more nuclear plants were ordered, the industrial infrastructure responded and commitments were made to enlarge existing facilities and build new ones. It rippled throughout the industry—more uranium development, more conversion capacity, more enrichment capacity, etc. etc. Again, in hindsight, we can observe that the suppliers were uncritical in their acceptance of these utility plans. With scarcely a look backward, they plunged ahead. Serious problems arose including (in no particular order of importance): environmental concerns, the Arab oil embargo, record high interest rates, escalating costs, conservation, economic distress, reduced load growth, and finally, the Three Mile Island incident. Incredibly, however, as these problems began to surface and multiplied and compounded, there was still hardly a look backward; investment continued to pour in and capacity continued to grow, even as the market for these products and services was shrinking rapidly.

Returning for a moment to the utilities, risk aversion translates into conservatism. As nuclear plants were ordered, the utilities became concerned about adequate supplies of fuel and services needed to run these plants. So they contracted for uranium, conversion and enrichment in quantities and on schedules to meet the most optimistic outcome. Too much, too soon might not be desirable, but, for a utility, too little or too late is entirely unacceptable.

In the best of cases, because some delays are inevitable, this meant taking and paying for materials and services before they were needed. In the worst case, which is cancellation of entire nuclear programs, it meant taking and paying for material and services for which there was no requirement at all. All utilities find themselves involved in a web of interlocking contractual commitments. To illustrate: a utility orders a reactor in 1972 for startup in 1980. You contract with General Electric for fuel fabrication services to meet that schedule. In order to provide enriched uranium to General Electric on a timely basis, you conclude an enrichment contract with U.S. DOE—a very long-term contract—30 years—with prohibitively expensive financial penalties for cancellation or late delivery. In order to meet your enrichment contract schedule, you have to contract for timely delivery of uranium and conversion services. Everything gets locked into place. Then your reactor is delayed until 1986, or worse, canceled altogether. Your uranium supplier who has borrowed millions from his friendly banker in order to develop his mine on the basis of your long-term supply agreement is not apt to release you from your obligation to take and pay.

Thus, secondary markets develop as utilities dump unneeded material and services. The reality of the new market has started to sink in. Producers and their bankers have become more skeptical. U.S. uranium production, which exceeded 43 million pounds $U_3O_8$ in 1980, will likely be less than 16 million pounds in 1983. Various Australian and Canadian projects have been deferred. DOE plans for increased enrichment capacity are being scaled back in size and delayed. The real arbiter is price and price is now performing its classic economic function.

As to the future, I would offer three observations which are based on Nuexco's long experience in the fuel cycle business.

1. Excess capacity and excess inventory ares bad enough, but these inventories have continued to grow as production continues to be greater than consumption.

The development of these excess inventories exert, in turn, enormous financial strain on the inventory holders which, in turn, leads to inventory liquidation. Such liquidation has led to a collapse of uranium spot prices and the development of severely discounted markets for conversion and enrichment services.

One is inescapably led to the conclusion that prices will be weak, and buyers will dominate the market until the inventory redistibution is complete. That point is a year or two off for uranium, and probably longer for conversion and enrichment. The bright spot is we can see the end and it is a year or two away for uranium. Furthermore, it is clear that production rates must and will, in time, be more nearly rationalized with consumption rates. We have seen the beginning of this rationalization. Bold new plans to produce more uranium, more conversion and more SWU, ran head first into the reality that there simply weren't enough buyers. Quite correctly more of these plans have been canceled or deferred.

2. Secondly, I would offer the opinion that the nuclear fuel market will be characterized by an unending series of boom-bust cycles. My reasoning is based on the fundamental nature of the utility charter; which, as noted earlier, is reliable service at the lowest possible rates consistent with a regulated rate of return sufficient to attract investment capital. If only five words could be used to describe utility business philosophy, I would choose the words "conscious policy of risks aversion."

This is not intended to be critical of utilities, but merely a statement of the way things are and must be. I personally prefer cheap electricity. However, I prefer expensive electricity to no electricity at all.

As also noted earlier, too much, too soon may not be desirable, but it is preferable to too little or too late. Too much, too soon dictates excess productive capacity, be it in uranium, conversion or enrichment. Excess capacity and inventory build-up lead to price weakness. Price weakness is followed by a dimunition of new capital investment, then later by utility concerns of future shortages, then later by high prices and so on.

3. A third conclusion relates to the inter-nationalization of the market. U.S. uranium is flowing to Europe, Taiwan, Korea and Japan. Canada, South Africa, Australia, Namibia and Niger also ship to customers around the world. U.S. utilities contract for conversion in Canada and Europe as well as the U.S. Europeans, Japanese, Taiwanese, Koreans and others buy conversion in the U.S., France, Canada, and the United Kingdom. The development of the secondary conversion market has added to this mix.

In the enrichment area, the monopolistic position of DOE is a thing of the past. Eurodif and Urenco have captured significant market share. The assignment and sale of SWU in the secondary market have become an enormous business crossing international boundaries with ease.

It is truly a world market. Embargoes and cartels, government sponsored or otherwise, designed to regulate commerce are doomed to fail, as are legislative attempts made in the name of non-proliferation. The efforts of the U.S. government in this area are the clearest demonstration of just how counter-productive such efforts can be. The dominant U.S. enrichment position has been lost; the U.S. is no longer viewed as a credible enrichment supplier and South Africa, Brazil and others are moving as rapidly as possible to create their own enrichment capacity. That's not what I would call a very effective non-proliferation policy.

In closing I would observe that the previous comments suggest a very complex market in which the financial stakes are enormous. Four hundred million pounds of excess $U_3O_8$ at $25 per pound represent a capital investment of $10 billion. At 15 percent, the carrying cost alone is $1.5 billion annually. If conversion and SWU are added, we are talking of waste, in our relatively small industry, of more than $3.0 billion annually.

Consider a European seller of enriched product which is physically located in Europe. Before the transaction is fully concluded, it may involve a Japanese buying SWU through a de-enrichment swap, followed by a U.S. utility purchasing the conversion component via a location and de-conversion swap, followed by Canadian producer purchasing the $U_3O_8$, after a nationality swap, for delivery at U.S. converter to a European buyer. This is not a flight of fancy. Such transactions do occur.

These are complicated deals, requiring technical skills, commercial savy, regulatory knowledge, timing and a fair measure of good luck. The market is not likely to settle down. Rather it is likely to be more volatile and increasingly complex.

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NUEXCO

OCTOBER 1983 NUMBER 182

# Monthly Report on the Nuclear Fuel Market

NUEXCO

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MONTHLY REPORT ON THE NUCLEAR FUEL MARKET

October 1983 No. 182

R. WESLEY MILLER, *EDITOR* JAMES J. LIGHTNER, *ASSISTANT EDITOR*

*PRICING*

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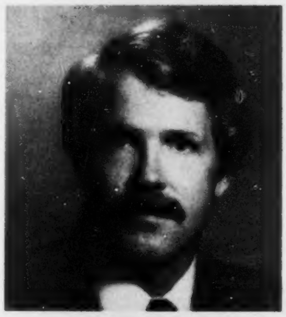
NUEXCO

*FOREWORD*

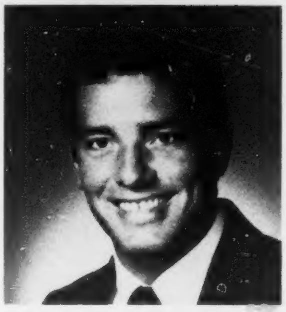
We take great pleasure in announcing the election of Mr. **Oren L. Benton** to Nuexco's Board of Directors. Oren was a long-time associate of Bob Adams and served as Vice Chairman of Energy Fuels before resigning in 1983 to devote full time to his responsibilities as trustee for Mr. Adams' estate and other trust arrangements. Prior to that Oren spent nineteen years with Arthur Andersen & Co., where he was a general partner specializing in tax matters. Oren brings to Nuexco a broad range of experience in finance, accounting, and deal making. His demonstrated ability to structure innovative and complex transactions in entrepreneurial areas will complement and reinforce Nuexco's existing capabilities.

* * *



We are also pleased to announce that Mr. **James H. Allen** has joined Nuexco as Regional Marketing Manager and will be associated with Jerry Reaves in our Atlanta office. Jim comes to Nuexco from Nuclear Resources International, where he was the director of Technical Analysis and a consultant on the enrichment market. Prior to that he was a Senior Engineering Analyst for Nuclear Assurance Corporation. Jim holds an MBA from Georgia State University and an MS in Nuclear Engineering from North Carolina State.

* * *



Another recent addition to Nuexco's staff is Mr. **James J. Lightner**, who is assisting Wes Miller with the production of the Monthly Report. Jim is a recent honors graduate of Stanford University.

* * *

Nuexco will have a hospitality suite during the Atomic Industrial Forum's annual conference in San Francisco, October 30-November 2. The suite will be located in the St. Francis Hotel. We look forward to seeing you there.

## NATURAL URANIUM

The **Exchange Value** as of September 30, 1983 is **$24.00** per pound $U_3O_8$, unchanged from last month. The *Current Market Data* section of this Report lists two uranium sales transactions, involving approximately 260 thousand pounds $U_3O_8$, *equivalent*. One transaction involved $U_3O_8$ and one involved natural $UF_6$.

**Active spot and near-term uranium supply** ($U_3O_8$ or natural $UF_6$ offered at competitive prices, terms, and other conditions) totals **7.2 million** pounds $U_3O_8$ equivalent, up 500 thousand pounds from last month. **Active spot and near-term uranium demand** rose 83 percent, to **4.4 million** pounds $U_3O_8$ equivalent. Therefore, the spot and near-term **supply-demand ratio** fell to **1.7:1.**

The **Transaction Value** as of September 30, 1983, is **$23.65** per pound $U_3O_8$, *equivalent*, an increase of $0.05 since last month. The current Transaction Value includes 21 transactions involving a total of 2.0 million pounds equivalent $U_3O_8$ and covers a period of six months.

The **Loan Use Charge Rate** as of September 30, 1983 is **6 percent** per annum. The entry of some new supply to the market in September is causing slight downward pressure on the loan rate, but no uranium loan transactions are reported.

* * *

The Exchange Value remained at $24.00 as of September 30, 1983, despite active uranium demand almost doubling. While several sellers have available large amounts of uranium, they appear unwilling to make offers much below the $24.00 level. However, at a time of somewhat increased demand the lack of buyer solicitations to purchase at current prices has also made sellers hesitant to raise offers above the $24.00 level.

## SECONDARY MARKET CONVERSION SERVICES

The **Conversion Value** declined $0.10 this month to **$1.00** per pound U as $UF_6$. Requests for secondary market conversion offers have prompted a flurry of seller activity, suggesting the continuation of a buyers' market.

One secondary market conversion transaction is reported this month. One US utility sold 101-300 thousand pounds U of conversion services to another US utility for delivery in 1984 at approximately 102 percent of this month's Conversion Value. **Active supply** of secondary market conversion services (inquiries to sell at competitive prices, terms and conditions) for delivery within the next three years declined to **5.4 million pounds U**, while active demand for the same period amounts to **1.8 million pounds U**, approximately one third the level of active supply.

* * *

Last month Report 181 listed a single conversion transaction. Although it involved only 50 to 100 thousand pounds U, that transaction had important implications for the secondary market. The price paid was approximately twice the secondary market conversion price then current in the USA. Both the buyer and the seller were European, and delivery was made by an exchange of $U_3O_8$ for $UF_6$ (deconversion swap) at a European converter.

Several US sellers actively pursued the European business with offers near the then prevailing Nuexco Conversion Value, but the business was awarded to the European seller. The costs associated with transporting yellowcake to the USA, shipping $UF_6$ to Europe, and returning empty cylinders to the USA (altogether approximately $2.00 per KgU), when added to the buyer's assessment of the price for conversion at Allied or Kerr-McGee, made the higher-priced European delivery more attractive. The most price-competitive offer still came from a US seller, even after allowing for transportation costs. However, the net price margin was small and, in the buyer's judgment, insufficient to justify the additional effort and perceived risk associated with the transportation problem.

The transaction signals a new development in the secondary market for conversion, as transportation has not been a significant factor in the past. In a typical secondary market transaction the seller's $UF_6$ is already located where the buyer desires delivery, or the seller can arrange to have $UF_6$ delivered where the buyer wants it at no additional cost. If these conditions are absent, the buyer must assume the cost of transportation or pay a premium for delivery as desired.

Nuexco's definition of Conversion Value has been clarified this month with a comment noting that the value does not take account of any transportation costs above those customarily borne by the primary converter. Had the conversion transaction reported last month (Transaction number 2449) been reported exclusive of unusual transportation charges, the price would have been shown as approximately 130 percent of last month's Conversion Value, rather than the 216 percent derived from the nominal price. Even after adjusting for transportation cost, the buyer still was willing to pay a substantial premium to avoid the transportation problem.

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*PRICING*

## SECONDARY MARKET ENRICHMENT SERVICES

The **SWU Value** for FY84 is **$90.00** per SWU as of September 30, 1983, down $5.00 since last month. The *Current Market Data* section of this report lists three SWU transactions, involving a total of approximately 200 thousand SWUs, all of DOE origin. In the near-term secondary market **active supply** totals **1.7 million SWUs** and **active demand** totals **1.4 million SWUs.** However, demand is virtually all discretionary and sellers are competing aggressively for each opportunity. The market is being led by sellers holding large quantities of Eurodif-origin SWUs.

## INTERIM SALES CONTRACT: EFFECT ON THE SECONDARY SWU MARKET

As mentioned last month in Report 181, DOE's issuance of the Interim Sales Contract (ISC) has lowered drastically the prices which sellers must offer to induce 3.5-year requirements contract holders to terminate and buy replacement SWUs on the secondary market. The ISC could have caused secondary SWU market activities to come to a halt if it had been accepted widely by active buyers or if secondary market supply had diminished. However, sellers of large quantities of Eurodif SWUs, having no reactors in which to use their excess commitments, promptly lowered their offering prices in order to remain competitive.

As a result of sellers' lower offering prices, the demand for secondary market enrichment services for FY84 and FY85 delivery has returned to pre-ISC levels. Those 3.5-year requirements contract holders that signed the ISC, thereby withdrawing from the market, were in most cases not secondary market participants in the first place. The few formerly active secondary market buyers that have withdrawn had previously expressed strong interest in buying only DOE-origin SWUs. Thus, their withdrawal comes at the expense of those sellers of AFC SWUs (DOE-origin) that had been unwilling to offer the lower prices necessary to compete with the Eurodif suppliers.

DOE 3.5-year requirement contracts cover 43 US reactors, 16 European reactors, and 8 Japanese reactors. A number of 3.5-year contracts had been partially terminated before the issuance of the ISC. Approximately 2 million SWUs for FY84 and 85 delivery had been terminated by US utilities, and 2.6 million SWUs for FY84 and 85 had been terminated by European utilites. Table 1 shows Nuexco's tabulation of estimated SWU requirements for those units still covered by the 3.5-year contracts at the time of issuance of the ISC.

### Table 1

### TOTAL SECONDARY MARKET POTENTIAL AT TIME OF ISSUANCE OF ISC

**(thousands of SWUs)**

| | FY84 | FY85 |
|---|---|---|
| USA | 2,240 | 1,330 |
| Europe | 150 | 120 |
| Japan | 540 | 550 |
| TOTAL | 2,930 | 2,000 |

The requirements summarized in Table 1 represent total potential secondary market demand from the 3.5-year requirements contract holders at the time of issuance of the ISC. Actual secondary market demand was less. A number of potential buyers have political or other institutional reasons not to terminate and buy replacement secondary market SWU, particularly of non-DOE origin. Table 2 and Table 3 show Nuexco's estimate of the secondary market potential of US and non-US buyers respectively at the time DOE issued the ISC.

As of October 1, 1983, three US utilities representing demand for 880 thousand SWUs for FY84 delivery and 260 thousand SWUs for FY85 delivery have either signed or are in the process of signing the ISC. Likewise, the Japanese customers of DOE holding 3.5-year requirements contracts, representing 540 thousand SWUs for FY84 and 550 thousand SWUs for FY85, reportedly intend to sign the ISC. No European utility has expressed interest in the ISC. Also, since the original offering of the ISC, one US utility terminated and bought on the secondary market 130 thousand SWUs for FY84. The current status is indicated in Tables 4 and 5.

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Only two US utilities that *previously had been in the market* decided to withdraw and sign the ISC. Their actions removed 130 thousand SWUs of FY84 demand and 210 thousand SWUs of FY85 demand from the secondary market for DOE SWUs. The remaining expected signees of the ISC had rejected previously the idea of terminating and buying replacement SWUs on the secondary market, despite the apparent economic advantages.

Potential buyers are continuing to participate actively in the market, confident that they will still be able to terminate their requirements contract deliveries and buy on the secondary market from sellers of Eurodif-origin SWUs at a substantial economic advantage. Sellers of DOE origin SWUs also have been forced to drop their prices to compete.

**Table 2**

**SECONDARY MARKET POTENTIAL AT TIME OF ISSUANCE OF ISC:
US UTILITIES WITH 3½ YEAR CONTRACTS
(thousands of SWUs)**

| Utility | FY84 | Origin Sought | FY85 | Origin Sought |
|---|---|---|---|---|
| A | 130 | DOE only | 0 | |
| B | 160 | DOE or Eurodif | 150 | DOE or Eurodif |
| C | 770 | DOE or Eurodif | 560 | DOE or Eurodif |
| D | 150 | DOE or Eurodif | 0 | |
| E | 220 | DOE | 210 | DOE |
| F | 360 | None specified | 50 | None specified |
| G | 390 | None specified | 0 | |
| H | 0 | | 160 | DOE or Eurodif |
| I | 0 | | 140 | DOE or Eurodif |
| J | 60 | DOE or Eurodif | 60 | DOE or Eurodif |
| TOTAL US | 2,240 | | 1,330 | |

**Table 3**

**SECONDARY MARKET POTENTIAL AT TIME OF ISSUANCE OF ISC:
NON-US UTILITIES WITH 3½ YEAR CONTRACTS
(thousands of SWUs)**

| Region | FY84 | Origin Sought | FY85 | Origin Sought |
|---|---|---|---|---|
| All Europe | 150 | DOE or Eurodif | 120 | DOE or Eurodif |
| All Japan | 540 | None | 550 | None |

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### Table 4

### SECONDARY MARKET POTENTIAL AS OF OCTOBER 1, 1983: US UTILITIES HAVING 3½ YEAR CONTRACTS

(thousands of SWUs)

| Utility | FY84 | Origin Sought or Current Status | FY85 | Origin Sought or Current Status |
|---|---|---|---|---|
| A | 130 | Will sign ISC | 0 | |
| B | 160 | DOE or Eurodif | 150 | DOE or Eurodif |
| C | 130 | Terminated | | |
| | 640 | DOE or Eurodif | 560 | DOE or Eurodif |
| D | 150 | DOE or Eurodif | 0 | |
| E | 220 | DOE | 210 | Signed ISC |
| F | 360 | Signed ISC | 50 | Signed ISC |
| G | 390 | Will sign ISC | 0 | |
| H | 0 | | 160 | DOE or Eurodif |
| I | 0 | | 140 | DOE or Eurodif |
| J | 60 | DOE or Eurodif | 60 | DOE or Eurodif |
| TOTAL US | 2,240 | | 1,330 | |

### Table 5

### SECONDARY MARKET POTENTIAL AS OF OCTOBER 1, 1983: NON-US UTILITIES WITH 3½ YEAR CONTRACTS

(thousands of SWUs)

| Region | FY84 | Origin Sought Or Current Status | FY85 | Origin Sought or Current Status |
|---|---|---|---|---|
| All Europe | 150 | DOE or Eurodif | 120 | DOE or Eurodif |
| All Japan | 540 | Expected to sign ISC | 550 | Expected to sign ISC |

*CURRENT MARKET DATA*

**EXCHANGE VALUE $24.00/lb. $U_3O_8$**
Determined as of September 30, 1983

**Definition**[1]

The Exchange Value is Nuexco's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the last day of the month.

**Derivation**

Nuexco bases the Exchange Value upon:

A. Data from recently completed transactions.
B. Data from pending transactions.
C. Firm bids to buy and firm offers to sell.
D. Prices purchasers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy, and prices sellers have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell.

**Comments**

Nuexco does not consider the following in determining the Exchange Value:

A. The price of uranium delivered or to be delivered under old contracts.
B. The price of uranium delivered in connection with contract renegotiations or other than arm's length transactions.

[1] In December, 1981, Nuexco published a history of the Exchange Value which chronicled, month-by-month, changes in its definition, usage and derivation. Copies are available upon request.

**TRANSACTION VALUE**[2]
Determined as of September 30, 1983

| $/lb. $U_3O_8$ | Millions of Pounds | Number of Transactions | Number of Months |
|---|---|---|---|
| 23.65 | 2.0 | 21 | 6 |

**Definition**

The Transaction Value is a weighted average price of recent transactions, and is based on prices paid for $U_3O_8$ in transactions closed within the previous three-month period and for which delivery was scheduled within one year of the transaction date. At least ten transactions totaling at least two million pounds $U_3O_8$ are included in each calculation, or the sample time is extended as necessary to include these minima. Foreign currencies are converted to US dollars as of the transaction date.

**Comments**

Nuexco does not consider the following in determining the Transaction Value:

A. The price of uranium delivered in connection with contract renegotiations or other than arm's length transactions.
B. The price of uranium delivered in connection with contracts which call for "market price" mechanisms. This exclusion applies particularly to contracts in which delivery prices are expressed as a function of Exchange Value or any other independent variable. Also excluded from consideration are all data where the delivery price is defined in such a way that it cannot currently be determined.

[2] Transaction Values for 1976 through 1981 and their associated parameters (millions of pounds, number of transactions and number of months) are tabulated on pages 31 and 32 of Report 161. Corresponding data for 1982 are tabulated on page 5 of Report 173.

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*CURRENT MARKET DATA*

**LOAN USE CHARGE RATE[2] 6%**
Determined as of September 30, 1983

**Definition**

The Loan Use Charge Rate is Nuexco's judgment of the annual interest rate at which uranium loans could be concluded as of the last day of the month.

**Derivation**

Nuexco bases the Loan Use Charge Rate upon:

A. Data from recently completed or pending loan transactions.
B. Rates included in firm proposals to borrow or lend.
C. Rates that potential borrowers and lenders have expressed as a willingness to pay or accept, but for which Nuexco is not aware of firm proposals.

[2] Monthly data for 1968 through 1981 appear on pages 32-34 of Report 162. Monthly data for 1982 appear on page 2 of Report 173.

**CONVERSION VALUE[1] \$1.00/lb. U as $UF_6$**
Determined as of September 30, 1983

**Definition**

The Conversion Value is Nuexco's judgment of the price at which spot and/or near-term transactions for significant quantities of conversion services could be concluded in the secondary market as of the last day of the month.

**Derivation**

Nuexco bases the Conversion Value upon:

A. Data from recently completed transactions.
B. Data from pending transactions.
C. Firm bids to buy and firm offers to sell.
D. Prices purchasers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy, and prices sellers have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell.

**Comments**

Nuexco does not consider the following in determining the Conversion Value:

A. The price of conversion services delivered or to be delivered under old contracts.
B. The price of conversion services delivered in connection with contract renegotiations or other than arm's length transactions.
C. Transportation charges other than those customarily provided by primary suppliers of conversion services.

[1] Monthly data for 1981 and 1982 are tabulated on page 6 of Report 173.

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*CURRENT MARKET DATA*

**SWU VALUE $90/SWU for FY84**
Determined as of September 30, 1983

### Definition

The SWU (Separative Work Unit) Value is Nuexco's judgment of the price, expressed in US dollars per SWU, at which transactions for the sale of significant quantities of SWU of any origin for delivery in the specified DOE fiscal year could be concluded as of the last day of the month.

### Derivation

Nuexco bases the SWU Value upon:

A. Data from recently completed transactions.
B. Data from pending transactions.
C. Firm bids to buy and firm offers to sell.
D. Prices purchasers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy, and prices sellers have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell.
E. SWU prices at varying tails assays and varying product assays are converted to the equivalent SWU price at the DOE Reference Transaction Tails Assay (presently 0.20 weight percent $U_{235}$) and a product assay of three percent $U_{235}$ assuming feed costs calculated using the Nuexco Exchange Value and Nuexco Conversion Value determined as of the last day of the same month.

### Comments

Nuexco does not consider the following in determining the SWU Value:

A. The price of SWU delivered under long-term contracts from primary suppliers, such as DOE, Urenco, or Eurodif.
B. The price of SWU delivered under other than arm's length transactions.

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*CURRENT MARKET DATA*

### EXCHANGE VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

| Country (currency) | per lb. $U_3O_8$ in Concentrates | per kg $U_3O_8$ in Concentrates | per kg U in Concentrates |
|---|---|---|---|
| Australia (dollar) | 26.74 | 58.95 | 69.52 |
| Belgium (comm. franc) | 1,284 | 2,831 | 3,338 |
| Canada (dollar) | 29.59 | 65.23 | 76.92 |
| Finland (markka) | 136.29 | 300.46 | 354.31 |
| France (franc) | 192.62 | 424.65 | 500.76 |
| FRG (mark) | 63.41 | 139.79 | 164.85 |
| Italy (lira) | 38,400 | 84,657 | 99,831 |
| Japan (yen) | 5,683 | 12,529 | 14,775 |
| Netherlands (guilder) | 70.88 | 156.26 | 184.27 |
| South Africa (rand) | 26.45 | 58.30 | 68.75 |
| Spain (peseta) | 3,653 | 8,053 | 9,497 |
| Sweden (krona) | 188.09 | 414.66 | 488.99 |
| Switzerland (franc) | 51.15 | 112.77 | 132.98 |
| UK (pound) | 16.03 | 35.34 | 41.68 |
| US (dollar) | 24.00 | 52.91 | 62.39 |

### TRANSACTION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

| Country (currency) | per lb. $U_3O_8$ in Concentrates | per kg $U_3O_8$ in Concentrates | per kg U in Concentrates |
|---|---|---|---|
| Australia (dollar) | 26.35 | 58.09 | 68.51 |
| Belgium (comm. franc) | 1,265 | 2,790 | 3,290 |
| Canada (dollar) | 29.15 | 64.27 | 75.79 |
| Finland (markka) | 134.30 | 296.08 | 349.15 |
| France (franc) | 189.81 | 418.45 | 493.46 |
| FRG (mark) | 62.48 | 137.75 | 162.44 |
| Italy (lira) | 37,840 | 83,423 | 98,376 |
| Japan (yen) | 5,600 | 12,347 | 14,559 |
| Netherlands (guilder) | 69.85 | 153.98 | 181.59 |
| South Africa (rand) | 26.06 | 57.45 | 67.75 |
| Spain (peseta) | 3,600 | 7,936 | 9,358 |
| Sweden (krona) | 185.34 | 408.61 | 481.86 |
| Switzerland (franc) | 50.40 | 111.12 | 131.04 |
| UK (pound) | 15.80 | 34.83 | 41.07 |
| US (dollar) | 23.65 | 52.14 | 61.48 |

[1] Calculated using currency exchange rates published in the Wall Street Journal on September 30, 1983.

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## CONVERSION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

| Country (currency) | per lb. U as $UF_6$ | per kg U as $UF_6$ |
|---|---|---|
| Australia (dollar) | 1.11 | 2.46 |
| Belgium (comm. franc) | 53.50 | 117.96 |
| Canada (dollar) | 1.23 | 2.72 |
| Finland (markka) | 5.68 | 12.52 |
| France (franc) | 8.03 | 17.69 |
| FRG (mark) | 2.64 | 5.82 |
| Italy (lira) | 1,600 | 3,527 |
| Japan (yen) | 236.80 | 522.05 |
| Netherlands (guilder) | 2.95 | 6.51 |
| South Africa (rand) | 1.10 | 2.43 |
| Spain (peseta) | 152.21 | 335.56 |
| Sweden (krona) | 7.84 | 17.28 |
| Switzerland (franc) | 2.13 | 4.70 |
| UK (pound) | 0.67 | 1.47 |
| US (dollar) | 1.00 | 2.20 |

## SWU VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

| Country (currency) | FY 1984 per SWU |
|---|---|
| Australia (dollar) | 100.28 |
| Belgium (comm. franc) | 4,815 |
| Canada (dollar) | 110.95 |
| Finland (markka) | 511.07 |
| France (franc) | 722.31 |
| FRG (mark) | 237.78 |
| Italy (lira) | 44,000 |
| Japan (yen) | 21,312 |
| Netherlands (guilder) | 265.80 |
| South Africa (rand) | 99.17 |
| Spain (peseta) | 13,699 |
| Sweden (krona) | 705.33 |
| Switzerland (franc) | 191.82 |
| UK (pound) | 60.12 |
| US (dollar) | 90.00 |

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[1] Calculated using currency exchange rates published in the Wall Street Journal on September 30, 1983.

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## *CURRENT MARKET DATA*

### RECENT TRANSACTIONS[1]

**Uranium Sales**

| Nuexco Transaction Number | Delivery Period | Approximate Quantity (thousands of pounds, $U_3O_8$ equivalent) | Approximate Price as Percent of Current E.V. | Seller | Buyer | Remarks |
|---|---|---|---|---|---|---|
| 2474 | 1984 | 101-300 | less than 108 | unknown | European Entity | $UF_6$ |
| 2493 | 1983 | less than 50 | 102 | US Producer | US Producer | |

**Uranium Loans**

| Nuexco Transaction Number | Delivery Period | Approximate Quantity (thousands of pounds, $U_3O_8$ equivalent) | Approximate Price as Percent of Current C.V. | Lender | Borrower | Remarks |
|---|---|---|---|---|---|---|
| | | | none reported | | | |

**Secondary Market Conversion Services**

| Nuexco Transaction Number | Delivery Period | Approximate Quantity (thousands of pounds, U equivalent) | Approximate Price as Percent of Current C.V. | Seller | Buyer | Remarks |
|---|---|---|---|---|---|---|
| 2473 | 1984 | 101-300 | 102 | US Utility | US Utility | |

**Secondary Market Enrichment Services**

| Nuexco Transaction Number | Delivery Period[2] | Approximate Quantity (thousands of SWUs) | Approximate Price[3] as Percent of Current SWU Value | Tails Assay (Percent $U_{235}$) | Seller Group | Buyer Group | SWU Origin | Remarks |
|---|---|---|---|---|---|---|---|---|
| 2458 | 1983 | 40 | 123 | unknown | US Utility | US Utility | DOE | |
| 2491 | 1984 | 60 | 109 | .2 | European Utility | US Utility | DOE | |
| 2492 | 1984 | 100 | less than 102 | .2 | See remarks | US Utility | DOE | Seller identity withheld to protect confidentiality |

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[1] Transactions listed are not limited to those in which Nuexco was involved, but also include others of which Nuexco is aware.
[2] Refers to quarter of calendar year, not fiscal year.
[3] Price is not normalized to 0.20% tails assay.

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## URANIUM SUPPLY
## (As of 9/30/83)

| Nuexco Project Number | Delivery Period[1] (Thousands of Pounds $U_3O_8$) | | Remarks |
|---|---|---|---|
| | Spot or Near-term[2] | Intermediate or Long-term[3] | |
| **Available for Sale:** | | | |
| **ACTIVE** | | | |
| 1575 | — | 500 per year | long term |
| 1818 | — | 250 per year | long term |
| 2017 | — | 2,300 | |
| 2038 | 2,000 | — | $UF_6$ |
| 2134 | — | 250 per year | 1984-87 |
| 2201 | 300 | — | |
| 2203 | 1,200 | — | |
| 2220 | 150 | — | $UF_6$ |
| 2235 | — | 100 per year | 1985-87 |
| 2236 | — | 200 per year | 1985-89 |
| 2245 | 450 | — | |
| 2246 | 40 | 100 | |
| 2275 | 70 | — | |
| 2288 | 80 | — | $UF_6$ |
| 2297 | 60 | 200 per year | 1985-89 |
| 2307 | 900 | — | $UF_6$ |
| 2309 | 1,000 | — | |
| 2315 | 450 | — | $UF_6$ |
| 2315A | — | 950 | $UF_6$ |
| 2320 | 350 | — | $UF_6$ |
| 2332 | 150 | — | $U_3O_8$ or $UF_6$ |
| 2365 | 20 | — | |
| TOTAL: | 7,220 | | |
| **INACTIVE** | | | |
| 1877 | 40 | — | |
| 2118A | 300 | — | $U_3O_8$ or $UF_6$ |
| 2121 | 600 | — | |
| 2271 | — | 500 per year | 1984-88 |
| 2191 | 125 | — | $UF_6$ |
| 2193 | — | 800 per year | 1986-90 |
| 2274 | — | 500 per year | 1985-91 |
| TOTAL: | 1,065 | | |

[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

[3] For delivery beyond one year.

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## URANIUM DEMAND
(As of 9/30/83)

| | Delivery Period[1] (Thousands of Pounds $U_3O_8$) | | |
|---|---|---|---|
| **Nuexco Project Number** | **Spot or Near-term[2]** | **Intermediate or Long-term[3]** | **Remarks** |
| **Inquiries to Purchase:** | | | |
| **ACTIVE** | | | |
| 1459 | — | 200 per year | 1985 on |
| 1995 | 270 | — | enriched $UF_6$ |
| 2010 | — | 400 per year | 1984-92 |
| 2115 | — | 250 per year | 1985 on |
| 2167 | 250 | 250 per year | 1984-99 |
| 2187 | 150 | — | |
| 2188 | — | 250 per year | 1985 on |
| 2233 | 700 | — | 1984, $U_3O_8$ or $UF_6$ |
| 2266 | 450 | — | |
| 2304 | — | 500 per year | 1988 on |
| 2310 | 800 | — | enriched $UF_6$ |
| 2313 | — | 200 | |
| 2316 | 150 | — | $UF_6$ |
| 2317 | 550 | — | |
| 2329 | — | 500 | |
| 2352 | 1,010 | — | $U_3O_8$ or $UF_6$ |
| 2393 | 45 | — | enriched $UF_6$ |
| 2416 | — | 430 | |
| TOTAL: | 4,375 | | |
| **INACTIVE** | | | |
| 1999 | — | 50 per year | 1985-90 |
| 2025 | — | 350 | |
| 2114 | — | 75 per year | 1984 on |
| 2244 | — | 350 per year | 1985 on |
| TOTAL: | | | |

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[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

[3] For delivery beyond one year.

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## LOAN SUPPLY AND DEMAND
(As of 9/30/83)

| Nuexco Project Number | Delivery Period[1] (Thousands of Pounds $U_3O_8$) Within 1 Year | Beyond 1 Year | Remarks |
|---|---|---|---|
| **Available for Loan: ACTIVE** | | | |
| 1815 | 1,000 | | $UF_6$ |
| 1938 | 1,500 | | $UF_6$ |
| 2128 | 1,500 | | |
| TOTAL: | 4,000 | | |
| **INACTIVE** | | | |
| 1884 | 600 | | |
| 2036 | 500 | | $UF_6$ |
| 2139 | 2,000 | | |
| TOTAL: | 3,100 | | |
| **Inquiries to Borrow: ACTIVE** | | | |
| 2118 | 250 | | $U_3O_8$ or $UF_6$ |
| TOTAL: | 250 | | |
| **INACTIVE** | None | | |

[1] Measured from the date of this Report

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*CURRENT MARKET DATA*

## CONVERSION SUPPLY
(As of 9/30/83)

| Nuexco Project Number | Delivery Period[1] (Thousands of Pounds U as UF₆) Within 3 Years | Beyond 3 Years | Remarks |
|---|---|---|---|
| **ACTIVE** | | | |
| 1840 | 130 | — | |
| 1936 | 1,500 | 200 per year | long term |
| 2051 | 1,500 | — | |
| 2141 | 1,500 | — | |
| 2143 | 300 | — | |
| 2220 | 400 | — | |
| 2222 | 80 | 175 | |
| TOTAL: | 5,410 | | |
| **INACTIVE** | | | |
| 1609 | 1,500 | — | |
| 2181 | 2,000 | 650 per year | long term |
| 2230 | 300 | — | |
| TOTAL: | 3,800 | | |

## CONVERSION DEMAND
(As of 9/30/83)

| Nuexco Project Number | Delivery Period[1] (Thousands of Pounds U as UF₆) Within 3 Years | Beyond 3 Years | Remarks |
|---|---|---|---|
| **ACTIVE** | | | |
| 2129 | 900 | — | |
| 2188 | — | 200 per year | 1985 on |
| 2199 | 100 | — | |
| 2328 | 800 | — | |
| TOTAL: | 1,800 | | |
| **INACTIVE** | | | |
| 2190 | 400 | 200 per year | 1986 on |
| 2194 | — | 300 per year | 1986 on |
| 2199 | 650 | — | |
| 2295 | 220 | — | |
| TOTAL: | 1,270 | | |

[1] Measured from the date of this Report.

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## ACTIVE SWU SUPPLY
## (As of 9/30/83)

| Nuexco Project Number | Delivery Period[1] (Thousands of SWUs) Spot or Near-term[2] | Intermediate or Long-term[3] | Remarks |
|---|---|---|---|
| 1859 | — | 5,000 | |
| 1971 | — | 250 | |
| 1984 | 120 | — | |
| 2100 | — | 200 | |
| 2192 | — | 410 | |
| 2273 | 100 | 150 | |
| 2285 | 950 | 6,000 | |
| 2375 | 200 | — | |
| 2385 | 300 | — | |
| TOTAL: | 1,670 | | |

## ACTIVE SWU DEMAND
## (As of 9/30/83)

| Nuexco Project Number | Delivery Period[1] (Thousands of SWUs) Spot or Near-term[2] | Intermediate or Long-term[3] | Remarks |
|---|---|---|---|
| 1850 | — | 500 | |
| 1856 | — | 500 | |
| 1860 | 240 | 760 | |
| 2233 | 250 | — | |
| 2237 | — | 150 per year | 84 and beyond |
| 2254 | 130 | — | |
| 2265 | 140 | — | |
| 2272 | — | 200 | |
| 2282 | — | 300 | |
| 2310 | 200 | — | |
| 2318 | — | 150 | |
| 2358 | — | 100 | |
| 2362 | 150 | — | |
| 2393 | 15 | — | |
| 2415 | 130 | — | |
| 2417 | 180 | — | |
| TOTAL: | 1,435 | | |

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[1] Measured from the date of this Report.

[2] For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

[3] For delivery beyond one year.

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## *RECENT DEVELOPMENTS*

### CANADA

In September the Canadian government announced that export contracts now can be approved for up to 15 years. Previously contracts could not exceed ten years. The announcement followed the completion of the government's review of uranium export policy.

Canada aims to guarantee security of supply for domestic utilities. This minor liberalization of the policy is attributable to the growth of national production and to historical cutbacks in projected domestic demand for uranium. Other aspects of the export policy were left unchanged. The government reaffirmed its longstanding pricing policy, specifically the requirement for a floor price. It also reaffirmed the policy requiring the upgrading of $U_3O_8$ to $UF_6$ before export, so long as Eldorado can supply the necessary services and its price for conversion is competitive on the international market.

* * *

In Report 181 (September 1983) Nuexco reported an anomaly after two CANDU reactors experienced problems in one week during August. The number of recent problems with CANDUs has escalated. From early August through mid-September, Ontario Hydro has encountered six leaks or spills at its Pickering, Douglas Point and Bruce generating stations. Several of these were small or routine problems, but the fact that they happened together has generated a series of press reports in Canada. The most serious occurrence was a cracked pressure tube in Pickering Unit 2. The crack reportedly was caused by corrosion and therefore raises the question of whether this is a generic problem with CANDUs. The raising of the issue comes at a bad time. CANDU has been pushing new sales to Korea, Romania, and elsewhere, and a key selling point is CANDU performance and reliability.

### JAPAN

For some years the peak power demand for the nine Japanese public utilities has occurred in the summer. According to the Federation of Electric Companies successive records for power generation were established in the summer of 1983. On July 26, 1983 a new record of 94,772 utilize feed and SWUs of non-US origin in their reactors. of 99,337 MW on August 5.

The new generation records were attributed to increased industrial demand due to improvement in the economy, as well as to an unusually hot summer, which prompted increased use of air conditioning. Japan's 24 commercial nuclear units concurrently have established a new record for availability. The reactors, which in 1982 generated approximately 20 percent of Japan's electricity while representing 13 percent of installed capacity, in August for the first time achieved an availability factor of 80.6 percent.

### SPAIN

Two new units were connected to the Spanish grid in September, increasing available nuclear generating capacity to 3,800 MWe. Asco I and Almaraz II, both 930 MWe PWRs, are operating smoothly under 18 month testing licenses. Almaraz I, which began commercial operation in 1981 but had a capacity factor of only 30.7 percent in 1982 because of steam generator problems, is operating again after the completion of repairs and alterations.

### UNITED STATES

The long-awaited Oak Ridge meeting to discuss the new DOE Utility Services enrichment contract (USEC) has been delayed until at least mid-November. A special DOE enrichment task force has not yet completed its review of the USEC, advanced technology options, pricing policies, and other topics. Decisions on these issues, desirable before the Oak Ridge meeting, will not be made before mid-October. DOE currently plans to allow two weeks for customers to review the contract before the meeting.

Testimony presented during July by the Congressional Budget Office (CBO) to the Congressional Subcommittee on Energy Research and Production reviewed the costs of technological options under consideration by DOE.

1. Under Option 1, the eight-building Gas Centrifuge Enrichment Plant (GCEP) complex would be completed and would use current technology. GCEP SWU production would begin in 1988 and reach full capacity by 1997, replacing approximately 50 percent of existing gaseous diffusion capacity.
2. Option 2 would utilize the Atomic Vapor Laser Isotope Separation (AVLIS) process. Laser enrichment would begin in 1994 and supplant gaseous diffusion capacity by 1999.
3. Option 3 would continue construction of the eight-building GCEP complex, as would Option 1, but set III and set IV centrifuge machines would be replaced completely in the 1990s by much more efficient set V machines.

The CBO's analysis concluded that Option 3 would be most economical, followed by Option 2 and Option 1. The CBO estimated average lifetime enrichment costs in 1983 dollars per SWU to be approximately $27 for Op-

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tion 3, $31 for Option 2, and $39 for Option 1. By comparison, the marginal unit cost of existing gaseous diffusion enrichment is approximately $95.

The repeated delays of the Oak Ridge meeting have promoted speculation and discussion of the USEC at a number of meetings of concerned industry personnel. Several have focused on the contract and its relationship to future enrichment alternatives. These people are wondering whether commitments to fund the continued development of advanced enrichment technologies in the hope of future cost reductions will cause DOE's competitive position in the primary SWU market to deteriorate.

The USEC also has emerged as an issue during the Energy Information Administration's (EIA) investigation into the viability of the US uranium industry. Some proponents of government restrictions on the importation of non-US uranium argue that, if the EIA determines that the industry is not viable, Section 161V of the Atomic Energy Act of 1954 requires DOE to stop enriching non-US uranium. This issue raises the concern of domestic utilities. If they convert to the USEC, they could be foregoing the freedom to buy non-US enrichment services, either in primary or secondary markets. If limited to DOE SWU supply, US utilities also could be required ultimately to use only domestic supplies of uranium. Presently all US nuclear utilities are allowed to utilize feed and SWUs of non-US origin in their reactors.

## CORRECTION

An error appeared in Report 181 for September 1983 in the article entitled "Australia's Potential as a Uranium Producing Nation." In the third paragraph on page 23 the article states that Teton Exploration Co. owns 25.5 percent of the Honeymoon project in South Australia. Teton, a subsidiary of UNC, sold its share of Honeymoon in March 1983. Presently CSR owns 34.23 percent and MIM owns 65.77 percent of Honeymoon.

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*COMMENTARY*

## SWU POLICY ISSUES

Nuexco's review of trends in the enrichment services market has raised a number of issues concerning future SWU prices. This article will not attempt to resolve those issues. Rather, it will summarize some of the most important questions for the consideration of our readers.

**Price Projections**

Various government agencies have reported apparently conflicting projections for DOE SWU prices.

1. In June of this year, the DOE issued a forecast of enrichment prices (in FY83 dollars) which showed a steady decline from the current $138 per SWU to about $112 in 1995. [United States Enrichment News, DOE, June 1983]

2. More recently, the DOE issued an even more favorable forecast, with prices as low as $70.00/SWU (in FY85 dollars) in 1995 declining to "about $50.00/SWU or less by the year 2000" if the Atomic Vapor Laser Isotope Separation (AVLIS) system meets expectations. ["New Enrichment Technology—What Can the Customer Expect?"; Fourth Annual Pacific Basin Nuclear Conference; Vancouver]

3. The Congressional Budget Office (CBO) has published an independent analysis, which agrees with DOE that the employment of either the advanced gas centrifuge or the atomic vapor laser technologies will result in lower enrichment costs in the long run (42 years). However, the CBO estimates average DOE costs for 1983-95 at *$230-$240 per SWU (in FY83 dollars).* [Nuclear Fuel; May 9, 1983]

4. The General Accounting Office (GAO), in a separate analysis of future DOE costs, has questioned the cost effectiveness of the Gaseous Centrifuge Enrichment Project (GCEP). Using DOE methods, but lower estimates of enrichment demand and power cost escalation, the GAO reports ". . . there are apparently no definite long-range cost reduction benefits associated with constructing GCEP. However, even if one accepts the position that building GCEP is economical, building the plant would not begin to reduce the average customer price for SWUs until after 1992." [Issues Concerning DOE's Justification for Building the GCEP", GAO/EMD-82-88, May 25, 1982, and Supplement GAO/EMD-82-88S, June 24, 1983]

QUESTION: As the Atomic Energy Act requires the full recovery of costs through revenues, what effect will the conflicting cost forecasts have on future DOE SWU prices?

**Financial Analysis**

As a result of the apparent conflict between the various government agencies on future DOE costs, it would seem worthwhile to investigate further the DOE cost structure. DOE prices are currently established on a complex system of cost accounts over a rolling 10-year period, and a complete analysis requires considerable effort. However, a cursory analysis of the 1984 DOE budget [United States Enrichment News, DOE, June 1983] indicates that further study is merited.

Total cash outlays in 1984, per the DOE budget, are $2.24 billion, or about $190/SWU for the 12 million SWU to be produced in 1984. After adding imputed interest and depreciation charges of $43/SWU, the total cost of a SWU produced in 1984 appears to be $233, within the $230-240 range of the CBO's estimated average SWU costs for 1983-1995.

**Conclusion**

The actual price of future DOE enrichment services will be the result of complex calculations involving expected future costs and enrichment demand. In addition, past price projections may have given very conservative treatment to technological improvements. Thus, there may be legitimate reasons for the apparent discrepancies in future price projections. However, as the DOE is required by law to obtain full cost recovery, its customers should develop a better understanding of the DOE cost structure prior to making significant decisions on future enrichment services.

The anticipated Utility Services enrichment contract will most likely require DOE customers to accept only DOE SWUs for the long term and forego the opportunities to seek competing supplies from foreign enrichers. Whether it is in a utility's best interests (and those of its stockholders and ratepayers) to forego the long-term benefits of competition in return for near-term price concessions is an issue of fundamental concern to utility managers, their supervisors, and regulatory authorities. Answers to this question and others raised in this article will be important to those utilities facing SWU market decisions in the next few months. Not all parties are likely to arrive at the same conclusions.

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## SUMMARY OF DOE SWU CONTRACTS

This article reviews the principal terms and conditions of six types of US Department of Energy (DOE) enrichment services contracts.

1. Requirements (two types);
2. Short-term Fixed-commitment (STFC);
3. Adjustable Fixed-commitment (AFC);
4. Draft Facility Requirements (FR);
5. Interim Sales (ISC).

### Requirements Contracts

Requirements contracts, offered between 1968 and 1972, were the first so-called toll enrichment contracts offered by the US Atomic Energy Commission (now DOE). Their name is derived from the option customers have to take only their actual enrichment requirements from DOE. From the customer's viewpoint, the requirements contract is the best contract form ever offered by DOE.

Covering enrichment needs for at most thirty years, all requirements contracts expire between 1988 and 2012. Under the terms of the contract, the customer agrees, at least in theory, to purchase from DOE all SWU requirements for the reactor covered by the contract. However, the contracts' provisions for termination without charge after a relatively short minimum rolling period (free termination) make the *effective term* either 3.5 or five years (less if termination charges are paid), much shorter than the theoretical *maximum term* of thirty years. At the end of the contract term, the customer is free to use SWUs of any origin.

The contract feature most important to the secondary market is that providing for *free termination.* For any given year beyond the minimum rolling period, a customer may partially terminate a requirements contract; that is, may specify a zero SWU requirement. The requirements contracts first offered by the AEC specified a minimum rolling period of 3.5 years, while the later form increased the period to five years. Thus, the two types of contracts are commonly called **5-year requirements** and **3.5-year requirements** contracts.

During the minimum rolling period, when free termination is precluded, the customer may terminate by paying charges specified in the contracts. *Termination charges* are assessed as a percentage of SWU contract price and vary according to the amount of advance notice given.

Upon contract execution (or at least six months before the year of first delivery), DOE and the customer must have agreed upon the estimated annual enrichment requirements over the life of the contract, as documented in an appendix to the contract. Those estimated requirements (Appendix A), cumulated to the year of delivery, constitute the quantity ceiling above which the customer does not have to take and DOE does not have to provide required enrichment services. Adjustments to Appendix A can be made later upon mutual agreement of both DOE and the customer. As a practical matter, DOE customarily allows downward adjustments in the Appendix A requirements if the customer can demonstrate that the adjusted amounts will cover anticipated requirements. Unapproved or late adjustments may be subject to charges for partial termination. If the number of SWUs must be increased—that is, if the reactor's requirements are greater than anticipated—DOE usually will agree to deliver the extra SWUs, provided that the necessary production capacity is available.

Every year, on January 1st for US customers and on November 1st for non-US customers, the contract holder must provide a *non-binding notice* of estimated annual SWU requirements for the minimum rolling period (5 or 3.5 subsequent years). Under current practices, DOE also asks that customers provide estimates of their requirements for five to ten subsequent years. As part of the annual non-binding notice, the customer will also provide an estimate of the number of SWUs in every month of the two subsequent years. While the information provided by the customer is not contractually binding, the notice must include proposed dates for deliveries, allowing at least 90 days between feed deliveries and withdrawals for the corresponding SWU deliveries.

At least 180 days in advance of SWU withdrawal, the customer issues to DOE a *binding notice* of the specific assays of feed and enriched product, and feed product quantities for a specific delivery. (The maximum enriched product and minimum feed assays must be within the assays specified in the DOE Standard Table of Enriching Services.) This is called a "firm-up" statement in that the 180-day notice becomes binding and may only be eliminated by termination (at a substantial charge) prior to SWU withdrawal. The current transaction tails assay under the Requirements Contract is 0.2 percent, subject to change by DOE on 180 days notice. (Requirements contracts do not offer the variable tails assay option.)

Table 6 shows the termination charges associated with various notice periods for the two different types of requirements contracts.

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*ANALYSIS & COMMENTARY*

### Table 6

### TERMINATION CHARGES UNDER REQUIREMENTS CONTRACTS
**(percent of SWU price for terminated SWUs)**

| Notice (years) | 5-Year Requirements | 3.5-Year Requirements |
|---|---|---|
| 0-1 | 40 percent | 25 percent |
| 1-2 | 40 percent | 20 percent |
| 2-3 | 40 percent | 20 percent |
| 3-3.5 | 40 percent | 15 percent |
| 3.5-5 | 40 percent | 0 percent |
| over 5 | 0 percent | 0 percent |

Another important feature of the requirements contracts is the inclusion of a *price ceiling*. The price for SWUs under this type of contract may not exceed a base price adjusted for escalation in power and labor costs (.75 x Power Index + .25 x Labor Index). During the 1970s, it was not uncommon for the ceiling price to be lower than the full cost recovery price. However, for the past few years, the ceiling price has not been limiting.

*Payment* for the delivery of SWUs must be made within 30 days of the DOE invoice date. This term was extended to 60 days for those holders of 3.5-year requirements contracts that accept the ISC offer except for deliveries in August and September 1983. Requirements contract *prices* (currently $149.85 for both 5-year and 3.5-year contracts) have usually exceeded AFC contract prices, but there is no apparent relationship between them.

**Fixed-Commitment Contracts**

The first fixed-commitment contract offered by DOE was the **Long-term Fixed-commitment (LTFC)** contract. It was basically a rolling ten-year take-and-pay contract. While a few such contracts still exist, the LTFC contract is no longer a significant factor in the market for enrichment services.

The **Short-term Fixed-commitment (STFC)** contract, offered for 10 months in 1974-75, was developed as a companion contract to the LTFC. Originally intended to allow fabricators to purchase small amounts of enrichment services, DOE later broadened its policy to allow the use of the STFC in all contracting situations unsuitable for long-term contract. The STFC was subsequently used as the foundation for the Interim Sales Contract recently offered to 3.5-year requirements contract holders.

The **Adjustable, Fixed-commitment (AFC)** contract replaced the LTFC contract in the late 1970s. It was DOE's response to customers' pleas for relief from excessive enrichment obligations caused by cutbacks in their nuclear programs.

In late 1982, DOE released the draft of a new contract form, the **Facility Requirements (FR)** contract. The revised version, unissued as of this writing, is to be entitled the **Utility Services enrichment contract (USEC)**. Although reported to be completely different from the FR draft, it is more likely that the USEC will be similar in many respects when issued.

Numerous contract provisions are common to the STFC, AFC, and FR (draft) contract types.

1. The customer must define the proposed month(s) of delivery at least **314** days in advance. The customer may also request specific delivery dates within the delivery month(s).
2. DOE must notify the customer of the firm date(s) of delivery at least **240** (275 in the FR draft) days prior to the beginning of the delivery month(s).
3. At least **180** days in advance of the firm SWU delivery date(s), the customer must specify the final quantities and assays (maximum enriched product and minimum feed assays to be within the assays specified in the DOE Standard Table of Enriching Services) of feed and product to be delivered.
4. A load-leveling provision allows DOE to alter delivery dates by up to two months, based on the values of three ratios calculated monthly. (The ratios relate to the distribution of DOE's scheduled SWU production over the six months preceding scheduled delivery.)
5. DOE may increase the 314, 240, and 180-day periods when the calculated ratios of monthly average demand exceed certain limits for an estimated month of delivery.
6. Feed deliveries to DOE must precede related SWU deliveries by 90 to 180 days as DOE may elect.
7. The price is the DOE fixed-commitment price in effect on the date of delivery.
8. Termination charges applicable to fixed-commitment type contracts are published in the Federal Register and revised periodically.

**Termination Charges**

The termination charges for fixed-commitment contracts (FC) are determined as percentages of the price of all terminated SWUs as of the date DOE received the termination notice. These percentages depend on the lead time given and the fiscal year the notice is given. These termination charges usually preclude secondary market purchases.

The termination charges for fixed-commitment con-

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tracts are reported in the Federal Register. Table 7 shows the charges reported in the notice dated November 28, 1980. A minimum charge is due, even if the number of SWUs affected by the termination of a given year's deliveries is zero. The minimum termination charge is equal to (0.2 N P), where N is the number of years terminated and P is the sum of prepayments due or effected for each gross MWe of contracted plant capacity. For those contracts which required no prepayment, P is set at $3,300/MWe.

**Table 7**

**TERMINATION CHARGES FOR DOE FIXED-COMMITMENT CONTRACTS**

| **Advance Notice Period (Years)** | **Termination Charge (Percent of SWU Price) if notice is received in FY** | | | | |
|---|---|---|---|---|---|
| | **83** | **84** | **85** | **86** | **87+** |
| 0.0-0.5 | 51.5 | 47.5 | 43.2 | 38.6 | 33.5 |
| 0.5-1.5 | 43.9 | 40.0 | 35.7 | 31.0 | 26.0 |
| 1.5-2.5 | 36.9 | 33.0 | 28.6 | 24.0 | 19.0 |
| 2.5-3.5 | 30.5 | 26.5 | 22.2 | 17.5 | 12.5 |
| 3.5-4.5 | 24.5 | 20.5 | 16.2 | 11.5 | 6.5 |
| 4.5-5.5 | 18.9 | 15.0 | 10.7 | 6.0 | 1.0 |
| 5.5-6.5 | 13.8 | 9.9 | 5.6 | 0.9 | 0.0 |
| 6.5-7.5 | 9.1 | 5.1 | 0.8 | 0.0 | 0.0 |
| 7.5-8.5 | 4.7 | 0.6 | 0.0 | 0.0 | 0.0 |
| 8.5-10.5 | 0.7 | 0.0 | 0.0 | 0.0 | 0.0 |

### STFC

The STFC contract is a short-term, take-and-pay contract. It must be executed no more than two years in advance of the DOE fiscal year of first delivery, but at least 180 days in advance of the month of first delivery. The STFC contract has a maximum term of 3 years, but may also be limited to just one SWU delivery, in which case the secondary market may be more advantageous. At time of execution, the customer and DOE agree on an enriching services schedule (Appendix A). This schedule defines the number of SWUs to be delivered in each **year** of the contract. At time of contract execution or at least six months prior to the fiscal year of first delivery, the customer must provide the estimated quantities of feed and assays of product (and notice of intention to use any enriched feed) to be delivered each **month** of the two subsequent years. This information is documented in another appendix (Appendix B), but is not contractually binding. Actual deliveries are firmed up by written notice 315 days in advance.

### Adjustable Fixed-commitment (AFC) Contract

DOE introduced this type of contract in 1978 to replace the Long-Term Fixed-Commitment (LTFC) contract. The two contracts are essentially identical but for two major exceptions.

1. The rolling delivery period to be specified by the customer was reduced from 10 to 5 years.
2. Within the rolling period, DOE granted more flexibility with respect to the number of SWUs delivered in a given year and to the tails assay.

The AFC contract may be executed for a minimum period of 10 years and a maximum period to the lifetime of a reactor. Execution of the contract must be 6-10 years before the fiscal year of first delivery. An advance payment of $4,656 (possibly a different sum if a contract was executed after 1979) per estimated generated MWe is due in two installments. The first installment ($600 per MWe) is due upon contract execution. The second installment (balance minus interest on first installment) is due 6 years prior to the first fiscal year of delivery. The prepayment accrues interest and is later applied against the first balance(s) due for the services provided. Additional payments, if any, are to be made within 30 days of the DOE invoice date.

*Annual* SWU requirements are firmed-up on a five year rolling period. Since the commitment for the fifth year is provided 15 months in advance of the first year of the five year rolling period, the contract actually contains six years of firm commitments documented in Appendix A. There are, however, some allowances for quantity flexibility. The fifth year of the rolling five year period is subject to +/-20 percent flexibility in the SWU commitment, and the fourth year is subject to +/-10 percent. Total quantity variation exercised for both years may not exceed +/-20 percent. The appendix also requires nonbinding estimates for the five years following the fifth year of the rolling period.

Included with its annual submissions, the customer must provide estimates of tails assays corresponding to the Appendix A SWU commitments. In addition, estimated *monthly* quantities and assays for the subsequent three year period must be given.

As part of the AFC contract, the customer may elect the variable tails assay option (VTAO) at least 15 months prior to the fiscal year of withdrawal. The VTAO allows the selection of tails assays between 0.16 percent and 0.30 percent. DOE may assess an efficiency loss penalty for tails assays below 0.2 percent, but the penalty has never yet been applied. This information is contractually binding.

The AFC contract contains two mechanisms by which

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a customer may obtain relief from excess SWU commitments. Prior to firming up the appendices, a customer may *delay* the initial delivery period (the first 5 years of commitments) as many times as needed for up to 5 cumulative years, paying one-fifth of the advance payment for each year delayed. Delay is the less expensive of the two mechanisms and is exercised by several utilities.

The second relief provision is the *deferral* option. Under this provision, upon 15 to 47 months advance notice, the customer can defer a delivery (and all succeeding deliveries) up to 5 years each time, as many times as needed. The charge for deferral is the difference in discounted cash flows resulting from the schedule adjustment. The discount rate to be used in the analysis is that in effect at the time of election as determined annually by DOE. The SWU price is the fixed-commitment price in effect at the time (currently $138.65).

Another important feature of the AFC contract is the substitution provision. When the customer specifies his SWU commitments for the fifth year of the rolling period, he may elect to reduce his requirements by the use of other DOE-enriched material (from his inventory or the secondary market). In effect, this option is available on a 6¼ year lead time. An active assignment market existed for several years as utilities reduced expected excess inventories through this mechanism.

### Facility Requirements (FR) Contract (Draft Of August, 1982)

The draft Facility Requirements (FR) contract offered DOE customers more flexibility, but at the cost of stronger penalties for contract terminations. DOE plans to release later this year a second version containing such drastic changes that it has been given a new name: the Utility Services enrichment contract (USEC).

The FR contract draft differed from the AFC contract in four important respects:

1. Reduced advance payments;
2. Shorter committed rolling period;
3. Heavy penalties for contract termination, similar to those applied to AFC contract termination. For a complete contract termination, the applicable number of terminated SWUs could be based on as many as ten years.
4. Requirements could be reduced through substitution of material originally enriched by DOE upon an advance notice of 30 months prior to the beginning of the year of delivery.

### Interim Sales Contract

It had become possible for holders of 3.5-year requirements contracts to achieve substantial savings by participating in the secondary SWU market. The mechanism used was the partial termination of their 3.5 year requirements contract. Even after paying the DOE termination charges (10-25 percent of the contract price per SWU), these buyers could buy secondary market SWUs to replace their terminated DOE deliveries and save enough money to justify the effort. Following private negotiations with at least two utilities, and after some hesitations caused by legal and policy questions, DOE offered the Interim Sales Contract (ISC) to all holders of 3.5-year requirements contracts.

The ISC is essentially a STFC contract modified to reflect a special 60-day payment term and 180-day notice on quantities and assays of feed and enriched product. It offers any 3.5-year requirements contract holder willing to waive the right to terminate and agree to take all FY83-85 SWU requirements from DOE a price reduction of approximately $11.20 per SWU. It reduces their price for FY83-85 from the requirements contract price (currently $149.85) to the fixed-commitment contract price (currently $138.65). It also doubles the payment term from 30 days to 60 days (except for deliveries that took place in August and September 1983). Although no termination for 83-85 SWUs is allowed after a DOE customer accepts the ISC, its net commercial effect has been to reduce the break-even price from $112.39 to $101.19 (see Report 180), and correspondingly to reduce the secondary market SWU price.

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## CURRENT URANIUM FORECASTS

This report presents the results of Nuexco's most recent analyses of nuclear electric generating capacity, apparent future consumption, uranium production, and the supply and demand balance in the Free World through 1992. Five observations about the nuclear power business lend credibility to these current forecasts.

1. Most of the nuclear power plants in the Free World are operational or under construction; relatively few are on order or planned. As the proportion of operational capacity has increased relative to the total capacity forecast, the predictability of the resultant uranium consumption has increased.
2. Fuel requirements can be estimated accurately on the basis of plant operating records.
3. Industry experience with governments and societies makes it possible to anticipate reactor delays and cancellations.
4. The development of a truly international uranium market has made it more difficult for governments to impose successful controls.
5. Uranium resources are adequate to meet all foreseeable need, and operating production facilities are reasonably secure after surviving the severe price fluctuations of the past decade.

The current market environment contrasts with the uncertainty Nuexco faced when preparing previous forecasts. The huge surpluses of uranium and fuel services acquired over the past decade, which have depressed prices so dramatically, are being reduced as consumption increases relative to production. Furthermore, those excess inventories are being redistributed by the operation of secondary markets.

## FORECAST OF APPARENT FUTURE CONSUMPTION

### Introduction

Nuexco's forecast of nuclear electric generating capacity as of September 30, 1983, presented in Table 8, provides the basis for the forecast of apparent future consumption of $U_3O_8$, quantified in Table 9. Nuexco expects Free World capacity to double by 1992 and consumption to increase by 45 percent.

The term *consumption* refers to *Nuexco's estimate* of the $U_3O_8$ which will be processed, fabricated and installed for the operation of a given nuclear power unit. Consumption comprises a portion of overall uranium demand commonly referred to as reactor demand or reactor requirements. Apparent future consumption should be distinguished from the unfilled requirements for uranium which nuclear power plant operators can be expected to purchase in the future. Unfilled requirements, which comprise the active market demand for uncommitted production, depend on current inventories, existing supply contracts, and individual utility procurement practices.

### Methodology

The forecast of nuclear electric generating capacity is based on an in-depth, country-by-country analysis of the probability that reactors presently operational, under construction, on order or planned will operate commercially during the next ten to fifteen years. Many of the considerations on which Nuexco bases its projection of capacity growth will not have important effects on consumption until after the ten year period covered in the current forecast. Considerations that figure prominently in longer-term projections include:

1. electrical load growth;
2. the economics of nuclear power compared to alternate means of electricity generation;
3. the financial condition of utilities and their capacity to adjust to high interest rates and rising construction costs;
4. national and international regulations, weapons safeguards and public opinion.

These longer-term considerations are less important in the forecast through 1992 because nuclear programs in most countries are firm for the next several years. In the USA and in many other nations, no future orders for nuclear units are likely to increase uranium consumption during the forecast period. The forecast does include provisions for some planned reactors in France and Japan because of the relatively short construction cycles prevalent in those countries, and because planning and approval processes there are such that substantial site and engineering work is done before actual orders are placed. The primary factors involved in Nuexco's forecast of installed capacity are:

1. construction progress to date on individual nuclear units and expected completion dates;
2. the size of those units;
3. anticipated delays due to regulatory action or design modifications;
4. the political, social and regulatory environment affecting each unit.

The subjective nature of some of these immediate considerations is reflected in a comparison of Nuexco's judgment with the projections of governments and other institutions. Nuexco's forecast is approximately 20 percent below cumulative national plans for nuclear generation in the nine countries having the largest nuclear programs in the Free World.

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Nuexco calculates apparent future consumption of $U_3O_8$ as a function of several reactor-specific variables.

1. *Reactor thermal power.* While the capacity forecast is expressed in terms of net electrical output, the calculation for consumption uses the design thermal output.

2. *Capacity factor.* Based on a tabulation of historical performance data over the period 1968-1982 and on expected future improvements in performance for five reactor types, Nuexco assumes capacity factor values shown in Table 10.

**Table 10**

**Nuclear Plant Capacity Factor Assumptions**

| Reactor Type | Percent |
|---|---|
| Boiling water reactor (BWR) | 60-65[1] |
| Pressurized water reactor (PWR) | 60-65[1] |
| Heavy water reactor (HWR) | 75 |
| Gas-cooled reactor (GCR) | 55 |
| Advanced gas-cooled reactor (AGCR) | 60 |

[1] Increases linearly over period 1982-1992.

3. *Fuel utilization improvements.* In LWRs which entered service after December 1968, technical improvements, principally extended fuel exposure, lead to reductions in consumption. The reductions are offset, however, by the transition to eighteen-month cycles, which will cause consumption to increase slightly during the forecast period. Modest improvements for heavy water reactors are expected by 1990 through the use of slightly enriched uranium (1.20 percent $U_{235}$) in reload fuel. No improvements are assumed for gas-cooled reactors.

4. *Refueling intervals.* $U_3O_8$ deliveries for first cores predate commercial operation by two years. (Some first cores, particularly for US nuclear units, have been fabricated in advance of this schedule and are not included in the calculation of apparent future consumption.) Delivery of first reload predates refueling outage by 12 months, and refueling intervals range between 12 and 18 months, depending on individual reactor schedules.

5. *Process losses.* 0.5 percent of the $U_3O_8$ being converted is lost during conversion.

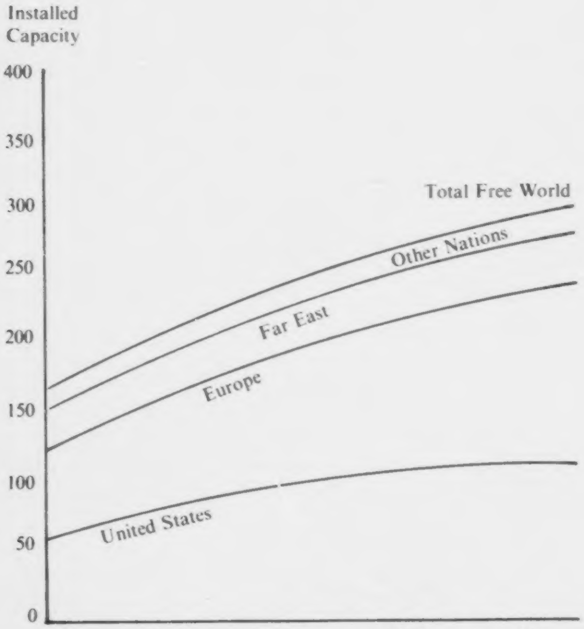

**Figure 1**
**Free World Nuclear Electric Generating Capacity (GWe or Thousands of MWe Net)**

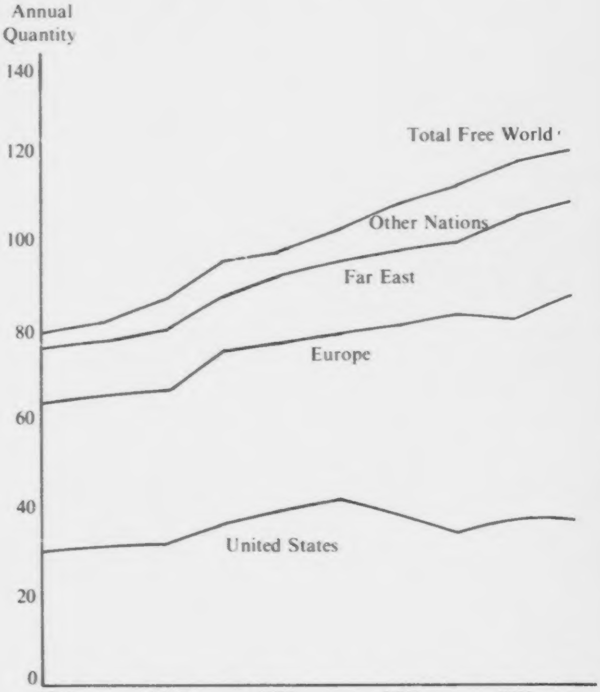

**Figure 2**
**Free World Uranium Consumption (Millions of Pounds $U_3O_8$ Equivalent)**

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6. *Enrichment tails assay.* The forecast assumes a tails assay of 0.25 percent $U_{235}$, representing Nuexco's judgment of the approximate average enrichment plant tails assay expected in the future. While DOE requirements contracts specify tails assays of 0.20 percent, holders of DOE adjustable fixed commitment (AFC) contracts, using the variable tails assay option (VTAO), are free to choose levels up to 0.30 percent. A low cost of feed material relative to high cost of SWU could allow a utility to save substantial amounts of money by exercising the VTAO.

7. *Fuel enrichment levels.* Average levels are based on known reactor specifications.

8. *Recycled fuel.* Although several countries reprocess spent nuclear fuel, the amont of recycled fuel probably will not be significant over the forecast period.

### Table 8
### NUCLEAR ELECTRIC GENERATING CAPACITY[1]
### (thousands of MWe—net)

| BUYER GROUP | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 |
|---|---|---|---|---|---|---|---|---|---|---|
| United States | 60.4 | 67.8 | 77.5 | 83.9 | 88.5 | 95.8 | 102.6 | 108.3 | 110.8 | 110.8 |
| Europe | 65.6 | 70.9 | 81.1 | 91.6 | 101.1 | 106.6 | 109.8 | 113.6 | 118.6 | 125.2 |
| Far East[2] | 21.0 | 22.6 | 26.8 | 30.6 | 34.4 | 37.0 | 38.3 | 41.3 | 46.0 | 48.5 |
| Other Free World[3] | 9.1 | 11.4 | 13.6 | 15.1 | 15.1 | 16.5 | 17.2 | 18.3 | 20.2 | 23.0 |
| FREE WORLD TOTAL | 156.1 | 172.7 | 199.0 | 221.2 | 239.1 | 255.9 | 268.9 | 281.5 | 295.6 | 307.5 |

[1] Uses Nuexco's estimate of commercial operating dates.

[2] Japan, Korea, Taiwan, Philippines.

[3] Excludes Bulgaria, Czechoslovakia, German Democratic Republic, Finland (two Russian Reactors), Hungary, People's Republic of China, Poland, Romania, USSR.

### Table 9
### APPARENT FUTURE CONSUMPTION[1]
### (millions of pounds $U_3O_8$)

| BUYER GROUP | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 |
|---|---|---|---|---|---|---|---|---|---|---|
| United States | 28.9 | 29.5 | 30.6 | 36.4 | 38.6 | 39.9 | 38.9 | 37.6 | 39.4 | 38.4 |
| Europe | 34.3 | 36.6 | 38.3 | 40.2 | 38.8 | 41.6 | 43.8 | 47.6 | 45.6 | 51.6 |
| Far East[2] | 12.0 | 12.3 | 13.7 | 13.5 | 14.5 | 14.7 | 18.3 | 17.9 | 21.4 | 19.2 |
| Other Free World[3] | 4.4 | 4.3 | 4.6 | 5.6 | 5.3 | 5.7 | 7.3 | 7.3 | 7.8 | 6.6 |
| FREE WORLD[3] TOTAL: | 79.6 | 82.7 | 87.2 | 95.7 | 97.2 | 101.9 | 108.3 | 110.4 | 114.2 | 115.8 |

[1] Computed quantities of $U_3O_8$ which would be used under the given conditions to fabricate fuel for loading and reloading reactors that are operating, under construction, or on order as of September 30, 1983. Compiled and computed on a reactor-specific basis, quantities for each reactor are based on specific core characteristics, 0.25% tails assay, no recycling, 24-month lead time for procuring first cores and 12 month lead time for procuring each reload. Estimates reflect annual consumption displaced in time to the start of the conversion-enrichment-fabrication cycle for timely loading into the reactor; they do not reflect refueling cycles. Some initial cores have been fabricated for units still under construction; uranium for these cores is not included in the data.

[2] Japan, Korea, Taiwan, Philippines

[3] Excludes Bulgaria, Czechoslovakia, German Democratic Republic, Finland (two Russian Reactors), Hungary, People's Republic of China, Poland, Romania, USSR.

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## FORECAST OF URANIUM PRODUCTION

### Results of Analysis

Nuexco's current forecast of Free World uranium production is quantified in Table 11. Based on an analysis of production centers that are operating, shut down temporarily, under construction and planned, Nuexco projects Free World uranium production of approximately 119 million pounds per year by the end of the forecast period.

Canada, rapidly expanding production in Saskatchewan (Report 181), has become the world's largest producer. Although some large uranium projects will be delayed into the next decade, the development and expansion of high-grade orebodies outside the USA will continue to increase Free World production. Other characteristics of production outside the USA are listed below.

1. Most non-US producers have long-term contracts, many of which call for negotiated prices, so low spot market prices affect them more slowly and to a lesser extent than US producers.
2. Captive production in regions like Central Africa remains somewhat protected from market forces, but Nuexco expects the sustained low-price trend to lead to reductions in some areas.
3. Uranium-gold co-product and by-product mining in South Africa will remain profitable as long as gold prices are not severely depressed.
4. Some older non-US commercial facilities will be phased out due to the same pressures of high cost and low grade which have affected US producers. However, decreases in production will be more than offset by increased production from high-grade reserves in Canada and Australia.

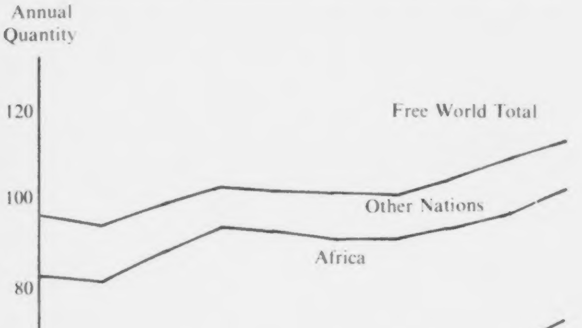

**Figure 3**
**(Millions of Pounds $U_3O_8$ per Year)**
**Free World Uranium Production Forecast**

In 1983, US production will be only 38 percent of the 1980 peak of almost 43 million pounds $U_3O_8$. Nuexco expects the USA to increase annual production to approximately 21 million pounds $U_3O_8$ by 1990, one fifth of the Free World total. New production facilities will account for less than 10 percent of total US output by 1987.

### Methodology

The production forecast is based on Nuexco's analysis of the following factors as they apply to individual projects:

1. quantity and grade of ore;
2. *variable costs* for production facilities that are financially established, and *full costs* for projects in the planning stage;
3. producers' financial conditions;
4. existing supply contracts;
5. the feasibility of obtaining new supply contracts;
6. political and regulatory environment.

Finally, Nuexco's production forecast is based on the premise that long-term prices for $U_3O_8$ will rise to stimulate enough production to satisfy demand.

## SUPPLY AND DEMAND ANALYSIS

### Results

Nuexco's most recent forecasts of production and consumption are compared in Table 12. The resulting supply-demand balance suggests that the uranium industry is on the verge of intermediate-term to long-term stability. Several conclusions may be drawn from the analysis.

1. Table 12 shows the forecast of world production of $U_3O_8$ exceeding consumption in each year through 1988, but, after 1985, by less than ten million pounds annually. During the first half of the ten-year forcast period, the relatively small cumulative imbalance between supply and demand will be relieved by annual additions to inventory.
2. During the second half of the forecast period, the situation will be reversed, as consumption exceeds production. However, the relatively insignificant supply shortfalls will be filled by withdrawals from inventory.

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## Table 11

## FREE WORLD URANIUM PRODUCTION FORECAST
**(millions of pounds $U_3O_8$)**

| | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 |
|---|---|---|---|---|---|---|---|---|---|---|
| Canada | 20.9 | 24.9 | 32.1 | 31.4 | 31.9 | 31.9 | 31.9 | 31.9 | 31.6 | 31.6 |
| United States | 16.3 | 12.2 | 15.3 | 17.1 | 17.2 | 18.2 | 18.3 | 20.9 | 22.5 | 22.3 |
| Australia | 10.5 | 10.5 | 10.5 | 10.5 | 10.5 | 9.2 | 8.0 | 10.0 | 12.8 | 17.6 |
| Republic of South Africa | 15.6 | 16.3 | 16.8 | 17.0 | 17.1 | 17.3 | 17.5 | 17.4 | 17.4 | 17.0 |
| Namibia | 9.8 | 10.0 | 8.5 | 8.2 | 6.5 | 6.5 | 6.5 | 6.5 | 6.5 | 6.5 |
| Central Africa[1] | 11.2 | 10.2 | 9.7 | 9.7 | 9.7 | 9.7 | 9.7 | 9.7 | 9.7 | 9.7 |
| France | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 |
| Other Nations[2] | 2.4 | 2.8 | 2.8 | 2.9 | 2.9 | 2.9 | 2.7 | 2.4 | 3.1 | 3.8 |
| TOTAL FREE WORLD[3] | 95 | 95 | 104 | 105 | 104 | 104 | 103 | 107 | 112 | 119 |

[1] Niger and Gabon

[2] Argentina, Belgium, Brazil, Chile, Mexico, Portugal, Spain and others

[3] Rounded to nearest million pounds $U_3O_8$.

## Table 12

## FREE WORLD URANIUM BALANCE
**(millions of pounds $U_3O_8$ equivalent)**

| | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 |
|---|---|---|---|---|---|---|---|---|---|---|
| BEGINNING INVENTORY | 408.9[1] | 424.0 | 436.2 | 452.7 | 461.8 | 468.4 | 470.2 | 464.5 | 460.9 | 458.3 |
| plus | | | | | | | | | | |
| PRODUCTION[2] | 94.7 | 94.9 | 103.7 | 104.8 | 103.8 | 103.7 | 102.6 | 106.8 | 111.6 | 118.5 |
| less | | | | | | | | | | |
| CONSUMPTION[3] | 79.6 | 82.7 | 87.2 | 95.7 | 97.2 | 101.9 | 108.3 | 110.4 | 114.2 | 115.8 |
| equals | | | | | | | | | | |
| ENDING INVENTORY | 424.0 | 436.2 | 452.7 | 461.8 | 468.4 | 470.2 | 464.5 | 460.9 | 458.3 | 461.0 |
| RELATIVE INVENTORY (years)[4] | 4.6 | 4.5 | 4.4 | 4.4 | 4.3 | 4.2 | 4.1 | 3.9 | 3.8 | 3.6 |

[1] Nuexco estimate.

[2] This Report, Table 11

[3] This Report, Table 9.

[4] For each year, Relative Inventory equals the number of years of forward consumption which could be supplied by that year's Beginning Inventory.

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3. The estimated Free World inventory of approximately 400 million pounds $U_3O_8$ equivalent as of January 1, 1983 represents approximately five years of forward consumption. Although the inventory level will increase through 1988, *relative inventory* will decrease steadily to an average level of four years consumption. If Free World relative inventory is computed without including the US, it is substantially more than four years' consumption well into the next decade.

4. Table 13 shows US uranium consumption exceeding US uranium production in each year between 1983 and 1993. Inventory reductions and contracted imports will offset most of the US production shortfall, but a significant supply deficit is expected over the ten-year period. Cutbacks in inventory are likely to result in reductions to a level of 1.5 years' relative inventory for US utilities by the end of 1988. Based on Nuexco's survey of utility attitudes, the analysis assumes they will maintain a collective minimum of 1.5 years' forward requirements in inventory.

**Methodology**

Consumption, inventory levels, desired inventory levels and contracted supply are the basic factors that must be known to calculate unfilled demand. Market demand can be higher or lower than consumption, depending on users' inventory levels and policies. For example, market demand would fall short of consumption if uranium inventories were reduced in order to fill need which otherwise would appear as demand. Market demand can exceed consumption if buyers deficient in inventory plan their procurement strategies in order to enhance security of supply. Demand also can exceed consumption if buyer obligations to suppliers of fuel cycle services require earlier purchase of uranium than a reactor's operating schedule dictates.

Nuexco determines individual utilities' inventory levels by analyzing data from a wide range of sources, including the utilities, published documents, and contacts throughout the industry. Nuexco estimates desired inventory levels on the basis of historical trends and utilities' known attitudes.

**Table 13**

**UNITED STATES URANIUM BALANCE[1]**
**(millions of pounds $U_3O_8$ equivalent)**

| | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 |
|---|---|---|---|---|---|---|---|---|---|---|
| BEGINNING INVENTORY | 134.4[2] | 127.8 | 114.9 | 105.6 | 91.7 | 75.7 | 61.6 | 56.0 | 56.7 | 57.9 |
| plus PRODUCTION[3] | 16.3 | 12.2 | 15.3 | 17.1 | 17.2 | 18.2 | 18.3 | 20.9 | 22.4 | 22.3 |
| less CONSUMPTION[4] | 28.9 | 29.5 | 30.6 | 36.4 | 38.4 | 39.9 | 38.9 | 37.6 | 39.4 | 38.4 |
| plus CONTRACTED NET IMPORTS[2] | 6.0 | 4.4 | 6.0 | 5.4 | 5.4 | 4.6 | 4.5 | 4.5 | 4.0 | 3.8 |
| plus UNFILLED DEMAND[5] | 0 | 0 | 0 | 0 | 0 | 3.0 | 10.5 | 12.9 | 14.2 | 12.8 |
| equals ENDING INVENTORY | 127.8 | 114.9 | 105.6 | 91.7 | 75.7 | 61.6 | 56.0 | 56.7 | 57.9 | 58.4 |
| RELATIVE INVENTORY (years)[6] | 4.2 | 3.8 | 3.2 | 2.8 | 2.3 | 1.9 | 1.5 | 1.5 | 1.5 | 1.5 |

[1] Assuming US utilities maintain at least 1.5 years' relative inventory.
[2] Nuexco estimate.
[3] This Report, Table 11.
[4] This Report, Table 9.
[5] Derived value to satisfy ending inventory requirements for a minimum of 1.5 years' relative inventory.
[6] For each year, Relative Inventory equals the number of years of forward consumption which could be supplied by that year's Beginning Inventory.

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## THE FEDERAL ENERGY REGULATORY COMMISSION

One of the most prominent characteristics of public utilities is that they operate at greatest efficiency as monopolies. In the absence of a competitive marketplace to restrain utility management, the USA has substituted government regulation. The stated purpose of government regulation is to provide reliable service for the consumer at reasonable rates and, in the case of investor-owned utilities, reasonable profits for the stockholders.

The energy regulatory structure in the USA reflects a division of powers between the individual states and the federal government, within which the most prominent energy regulating body is the Federal Energy Regulatory Commission (FERC). The five Commission members, one of whom is designated as Chairman, are appointed for four-year terms by the President, (with the advice and consent of the Senate). FERC is responsible for developing, managing, and directing energy regulatory programs and activities assigned to it by statute, executive order, or by the Energy Secretary. An independent organization within DOE, FERC is not subject to the supervision or direction of any other DOE official.

FERC is a direct descendent of the former Federal Power Commission (FPC). The FPC originated with the passage of the Federal Water Power Act of 1920. At that time, the FPC's power was limited to licensing the construction of dams across navigable waters. The inability of the Interstate Commerce Commission or the FPC adequately to regulate electric and gas utilities led to the passage of the Federal Power Act in 1935. That act gave the FPC jurisdiction over securities, accounts, and interstate rates and service of all interstate electric utilities, and instructed the FPC to devise plans for the interconnection and coordination of electric facilities. The FPC's jurisdiction was extended to the regulation of natural gas in interstate commerce by the Natural Gas Act of 1938.

On September 30, 1977, Congress passed the Department of Energy Organization Act. Among other things, the DOE Act created FERC and transferred to it most of the FPC's interstate regulatory authority over the electric power and natural gas industries. In addition, FERC was given the authority to determine oil pipeline transportation rates and to set the value of oil pipelines for rate-making purposes, and it was given a combination of review functions over DOE actions.

In October 1978, passage of the National Energy Act gave FERC the authority to regulate producer sales of natural gas in intrastate commerce. FERC established uniform ceiling prices for each of several categories of natural gas, and those prices now apply to all gas sales nationwide.

With respect to the electric power industry, FERC establishes and enforces rates for the transmission and sale for resale of electric power in interstate commerce. It regulates permanent interconnections of electric utilities and ensures the adequate supply of interstate electric power service. FERC also regulates the issuance of all regulated electric utility securities as well as the mergers of regulated electric utilities. Finally, FERC established and enforces the Uniform System of Accounts, a body of accounting rules and procedures for the electric utility industry. Nuclear fuel accounts include:

1. 120.1—Nuclear fuel in process of refinement, conversion, enrichment and fabrication;
2. 120.2—Nuclear fuel materials and assemblies (stock account);
3. 120.3—Nuclear fuel assemblies in reactor;
4. 120.4—Spent nuclear fuel;
5. 120.5—Accumulated provision for amortization of nuclear fuel assemblies.

The techniques for treatment of nuclear fuel items in these accounts determine whether such items will accrue AFUDC (Allowance for Funds Used During Construction), or will be included in a utility's rate base, or will be held as non-revenue-producing inventory assets.

The **Office of the Chief Accountant** within FERC is responsible for the Uniform System of Accounts and for related reporting requirements, accounting rules and procedures, securities issuances, and audits of companies under federal jurisdiction. Reporting to the Chief Accountant are the Division of Accounting Systems and the Division of Audits. Nine other major offices comprise the internal structure of the agency.

The **Executive Director** is responsible for exercising executive and administrative authority delegated by the Commission member designated as Chairman, and supervising the regulatory functions of FERC. The major divisions within the Office of Executive Director are the Division of Budget and Administrative Liaison with the DOE, the Division of Planning and Evaluation, the Office of Public Information and the FERC Regional Offices.

The **Office of the General Counsel** is responsible for the conduct of all FERC litigation, the review of all FERC documents, the management and promulgation of standards of conduct, and all legislative and legal matters.

The **Office of Administrative Law Judges** is responsible for the conduct of all "on the record" hearings and such other hearings as directed by FERC.

The **Office of the Secretary** acts as the point of contact between the Commission and all those having business before it. The Office of the Secretary receives and distrib-

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utes pleadings filed with FERC, sets FERC's meeting agenda, attends meetings and records votes, and performs FERC's records management functions and regulatory support functions.

The **Office of Regulatory Analysis** provides policy advice and technical assistance to the Commission and the Office of Opinions and Reviews. The Office of Regulatory Analysis has five divisions: Finance, Economics, Analysis and Policy Development, Technology, and Environmental Advisors.

The **Office of Electric Power Regulation** is responsible for all technical matters involving electric utilities, except for those functions delegated to the Office of Regulatory Analysis. This Office is comprised of the following divisions: Rates and Corporate Regulation, Licensed Projects, Interconnections and Systems Analysis, and River Basins.

The **Office of Opinions and Reviews** is responsible for the analysis of administrative hearing records and other contested actions before FERC. This Office also reviews exceptions to initial decisions issued by Administrative Law Judges and will prepare opinions and orders for FERC.

The **Office of Pipeline and Producer Regulation** provides technical advice and assistance to rate-making bodies on the transportation and sale of natural gas and oil by pipeline, the issuance of certificates of public convenience and necessity for pipelines and producers, and the establishment and enforcement of gas curtailment provisions. This Office is made up of eight divisions, including Curtailment and Pipeline Systems Analysis, Pipeline Rates and Tariffs, Pipeline Cost Valuation, Pipeline Certificates, Producer Rates, Producer Certificates, Reserve Evaluations, and Compliance.

The **Office of Enforcement** is responsible for administrative proceedings that ensure enforcement of statutes and FERC rules, orders and regulations.

FERC performs its regulatory functions in two ways; rulemaking and adjudication. In the case of rulemaking, FERC may propose a general rule or a change in its regulations. However, it must issue a notice of the proposed rule and a request for comments in the Federal Register, publishing any final decision along with the comments it receives. Alternately, FERC may consider on a case-by-case basis, applications submitted by the companies it regulates. Objectionable proposals must be submitted to a hearing presided over by one of the agency's administrative law judges. A decision by such a judge may be adopted, modified, or reversed by the Commission. Any decision may be appealed to the US Court of Appeals and ultimately to the US Supreme Court.

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## THE LODEVE URANIUM PROJECT

### Introduction

The uranium occurrences at Lodeve represent one of the largest and most important discoveries in France. At least two important deposits had been discovered by 1957 following nearly four years of exploration in the Lodeve district of Herault. The original resource estimate for the deposits was approximately 48 million pounds $U_3O_8$, representing at the time 30 to 35 percent of reasonably assured resources recoverable at US$30.00 per pound in France. Additional discoveries were made as exploration progressed. Presently two deposits are being mined, two are in the final stages of evaluation, and several more discoveries have been recorded and are in various stages of evaluation. Annual production of uranium concentrate at Lodeve exceeds 2.3 million pounds $U_3O_8$, about 30 percent of domestic French production. Present ore reserves for the Lodeve district are approximately 42 million pounds $U_3O_8$.

The French uranium exploration program was initiated in 1946 when the government created the Commission for Atomic Energy (CEA). The exploration effort began in the granitic rocks of the Massif Central where radioactive occurrences were known from historical exploration and from mining operations for radium and other minerals. The sedimentary basins surrounding the Massif Central also were considered potential for uranium deposits due to the geologic relationship of granitic and volcanic source rock, and associated mineralization.

The CEA exploration effort experienced early success by making important discoveries in the granite environment at La Crouzille in 1948. A number of discoveries had been made by 1954, primarily around the eastern and western limits of the Massif Central. Exploration of the sedimentary basins began about that time, resulting in the discovery at Lodeve in 1957.

More than 70 uranium occurrences have been discovered throughout France by the CEA and industrial groups who had initiated separate exploration programs in the early 1950s. A number of important discoveries were made and mine development was soon undertaken on the more favorable deposits. Lodeve is the newest production center in France. Presently there are five other mine and mill facilities producing uranium concentrates. Nuexco estimates that 1983 production will total about eight million pounds $U_3O_8$, of which approximately 2.4 million pounds will be produced at Lodeve.

The Lodeve mine is operated by Compagnie Generale des Matieres Nucleaires (COGEMA) which is a subsidiary of CEA. The processing plant is operated by Societe Industrielle des Minerais de l'Ouest (SIMO), a subsidiary company to COGEMA. SIMO designed the processing plant, supervised construction and is the operator. The two companies operate under the same relationship at the Bessines and Ecarpiere mine and mill production centers located in central and northwestern France.

CEA obtained the right to exploit known ore deposits at Lodeve in 1966; however, it was April 1979 before the license to build a processing plant was granted, and September 1980 when a production license was granted. The concession area is designated as area A on Figure 4. Four important ore deposits are located on the Lodeve concession. COGEMA has exploration permits on the Merifons and Graissessac districts, designated as areas B and C on Figure 4.

Paris
FRANCE
Nuexco France
Lodeve

### Ore Deposits

Two ore deposits presently are being mined at Lodeve. The ore occurs in host rock of carbonaceous sandstone, mudstone and dolomite. The largest, designated the Mas Lavayre deposit, was estimated to contain approximately 36 million pounds $U_3O_8$ (14,000 metric tons U) at an ore grade of 0.20 to 0.50 percent $U_3O_8$. The depth to the upper ore zone is about 130 meters; the base is about 320 meters. The deposit is confined primarily between two major fault systems (the Rivieral on the down-dip side, and the St. Julien on the up-dip side). The faults serve as a principal geologic control for mineralization. The principal uranium minerals are pitchblende and coffinite closely associated with iron sulfides, molybdenum and organic bituminous material. Orebody dimensions are roughly 1500 meters parallel to the faulting; the width varies from 200 to 600 meters between faults. The deposit is being mined by underground methods.

The second important deposit is known as the Mas d'Alary. It and the smaller Treviels deposit, which is an extension on the same mineral trend, contain approximately 11.7 million pounds $U_3O_8$ (4,500 metric tons U) at an average ore grade of 0.17 percent $U_3O_8$. Uranium mineralization occurs in a sandstone-mudstone formation about 800 meters north of the Mas Lavayre deposit. The ore has accumulated as lenticular bodies in the stratified sediments and is confined laterally by paralleling faults. The South fault is on the down-dip side; the Central fault is on the up-dip side. Ore was discovered near the surface and to a depth of about 65 meters. The Mas d'Alary is being mined by open pit methods; the Treviels is scheduled for open pit mining in the near future.

**Mining**

The ore reserves at Lodeve were well defined by 1966. COGEMA completed a project feasibility study and applied to the local government administrator for permission to mine and mill ore from the Mas Lavayre and Mas d'Alary deposits. Permission was granted in September 1966 for mine development. Underground development at Mas Lavayre began in 1975; surface mining began at Mas d'Alary in 1978.

Two declines provide access to the ore in the Mas Lavayre deposit. The main entryway is decline "A" which is designed to handle all vehicle traffic. It descends at a grade of 17 percent and is 1900 meters in length. It spirals downward at a 45° turn 330 meters from the portal,

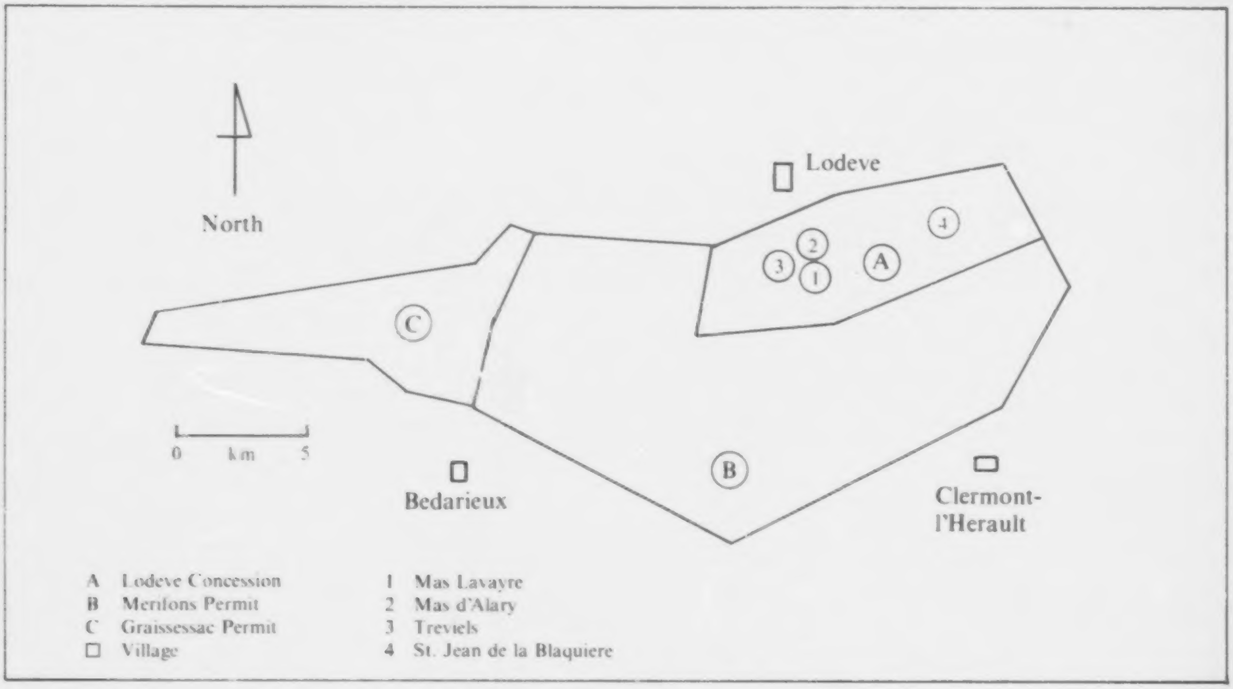

**Figure 4**

**Outline of Lodeve Project Area, Herault Province, Southern France**

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followed by two U-turns to the base of the ore zone. The "A" decline is located entirely within the footwall of the Rivieral fault, allowing complete access to the entire ore deposit. Five drifts have been driven at various levels off the decline and into the ore zone. Mining is conducted through the three lower drifts only.

Decline "B" is the second entry into the deposit. It is designed to remove ore and waste from the mine by a conveyor system. It has a straight descent of 25 percent from surface to the lowest part of the mine and has an overall length of 1300 meters.

Ore passes connect each working level. Mining ore (and waste) is dropped through an ore pass to a crusher station located at the bottom level. All rock is crushed and fed onto the conveyor belt, traveling to the surface at a rated capacity of 250 tonnes per hour.

Ore is extracted by driving access drifts through the length of an ore zone. Cross cuts are driven on a spacing of 5 to 10 meters at right angles to the access drifts through the minable ore zone. The pillars between cross cuts are extracted at a rate coordinated to back-filling procedures. Upon completion of an ore extraction sequence, the mined-out area is immediately back-filled. Waste rock is crushed and mixed with cement, forming a slurry which is pumped into the mined-out space. The mining-backfilling technique permits safe and total extraction of each ore zone.

The open pit mine is being developed by conventional strip mining techniques. The overburden is blasted and removed; benches are developed as required to maintain pit walls at a slope of 1:1 over 5 meters. Exposed and broken ore is graded by a sampler using a gamma ray probe. The sampler directs mining of ore to maintain proper grade control. As one section of the deposit is mined out, the pit is back-filled with mill tailings.

Removal of overburden from the Mas d'Alary deposit began on the shallowest and smaller portion of the ore zone. The pit is developing southward to include the deeper ore. Approximately 13 million tonnes overburden had been removed by the end of 1982; mined ore totalled almost 1.5 million pounds $U_3O_8$. Another seven to nine million tonnes overburden will be removed to gain full access to remaining ore. The pit will eventually be extended northward to include the mining of near-surface ore extensions including the Traviels and Les Mares deposits. New pits will be developed to mine the more favorable satellite deposits. Figure 5 is a recent photograph of the Mas de'Alary open pit.

## Ore Processing

The uranium ores in the Lodeve district occur primarily in carbonaceous sandstone and dolomite host rock. Sulfides containing up to 1 percent sulfur and small quantities of molybdenum occur in close association with uranium and organic material (humic acid and bitumen). The mineral combination presented difficult metallurgical problems. SIMO developed an alkaline leach process to obtain maximum recovery of uranium from the ores. (All other recovery systems in France utilize an acid leach process.)

The alkaline process includes a pre-leach period of three hours at a temperature of 140° C in an oxygen-rich environment. Sodium carbonate and siderite ($FeCO_3$) are added to the resulting pulp as it passes into a secondary leach cycle of 6 hours at the same temperature. The uranium, molybdenum and organics remain in solution.

The uranium is precipitated by the addition of lime. The organic material follows the uranium and is eliminated by roasting at a temperature of 650° C. The molybdenum remains in the primary effluent and is concentrated by evaporation; the concentrate is treated to recover the molybdenum and to eliminate any remaining traces of organics. The final stage of precipitation and concentration of the uranium is accomplished by the addition of milk of magnesia to form a product of magnesium uranate which contains at least 70 percent $U_3O_8$. Figure 6 shows the layout of the processing plant.

## Geology

The regional geologic setting of the uranium district is represented by a series of structural basins situated on the southern limits of the Massif Central. The Massif Central is a broad mountainous highland region that occupies much of central France. It consists basically of a granitic core with associated schists and gneisses formed by metamorphism of intruded sediments. The highlands of the Massif Central developed during the Hercynian Orogeny which has been age dated at 325 to 350 million years.

Tectonic action was renewed during the Alpine Orogeny of Late Cretaceous and Early Tertiary time (estimated at 135 to 65 million years). Structural development of the Lodeve province was rejuvenated. Tectonic activity, including regional faulting and subsidence, preserved the east-west trending basin structures; but more importantly, it preserved intact the lower series of Permian sedimentation. All uranium at Lodeve is found in Lower Permian rocks.

The Permian Formation is divided into two main units. The upper unit is the Saxionian which is approximately 1400 meters thick. It consists of alternating fine-grained sediments that are only occasionally mineralized near the base. Only one small ore deposit has been discovered in the Saxionian, but widely scattered occurrences of low-grade mineralization are not uncommon.

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The lower unit is the Autunian; it is the principal uranium-bearing sequence. The basal section of the Autunian is a conglomerate which is in unconformable contact with older Paleozoic and Precambrian rocks. Overlying the conglomerate is a 600-meter-thick sequence of stratified (one meter or less thick) alternating beds of fine-grained carbonaceous sandstones and mudstones, and bituminous dolomites and limestones. Gray zones in the predominantly red Permian beds outline alteration channels created by mineral-rich solution activity.

**Mineralization**

The main controls for mineral deposition appear to be a combination of tectonic and stratigraphic features in an altered zone within a Permian Basin. Uranium and associated minerals have accumulated within the alteration channels of stratified beds, primarily in close relationship to the increasing percentage of carbonate and bituminous matter. The alteration pattern reflects a strong east-west trend associated with regional tectonics. The most important mineralization is located along the flanks of channels and at abrupt stratigraphic changes where oxidation and reduction appear to be more intense Usually these zones show a high degree of fracturing and brecciation related to tectonic activity.

The uranium minerals pitchblende and coffinite, plus the miscellaneous mineral assemblage, are concentrated on the fractured surfaces of broken and altered rock. In addition, mineralization has concentrated in the more permeable sandstone units within the gray zones to form lenticular ore deposits, usually in close proximity with structurally controlled ore. Remobilization of uranium has occurred along faults and fracture zones, sometimes resulting in thicker and higher grade deposits.

The source of uranium mineralization is probably volcanogenic. Widespread volcanic activity erupted throughout the Massif Central during this period. Mineral-rich solutions formed during the weathering process of volcanics and granites of the Massif Central. The solutions migrated downward into Permian rocks. Stratigraphic and tectonic conditions controlled the precipitation of uranium and molybdenum in the presence of a bituminous-rich (reducing) environment.

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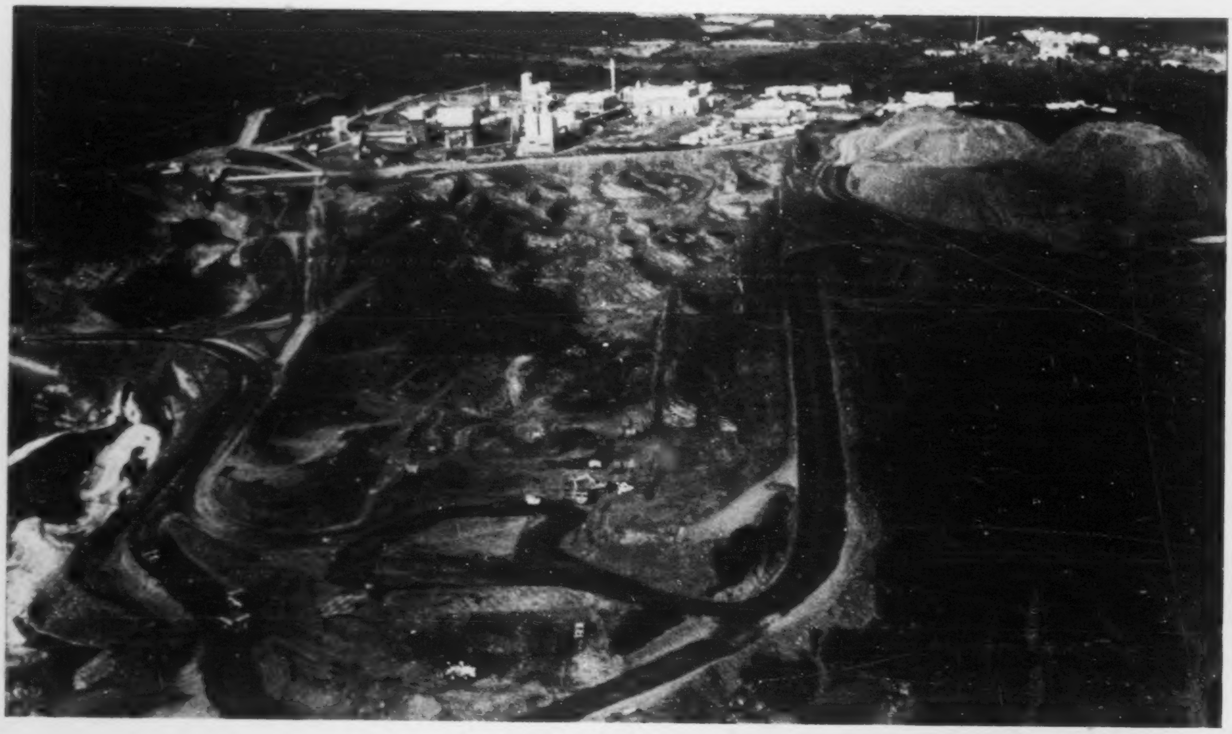

**Figure 5**

**Aerial View of the Mas d'Alary Open Pit and Processing Plant at Lodeve**

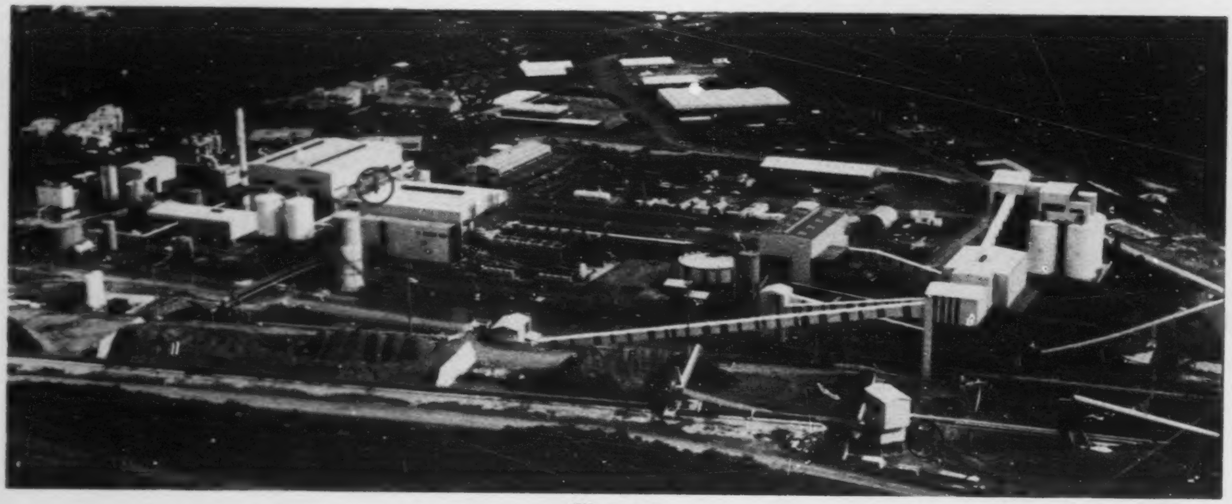

**Figure 6**

**Uranium processing plant at Lodeve. (1) Ore delivery from underground mine; (2) crushing circuit; (3) pressure leach circuit; (4) ion exchange and precipitation circuits; (5) administrative offices**

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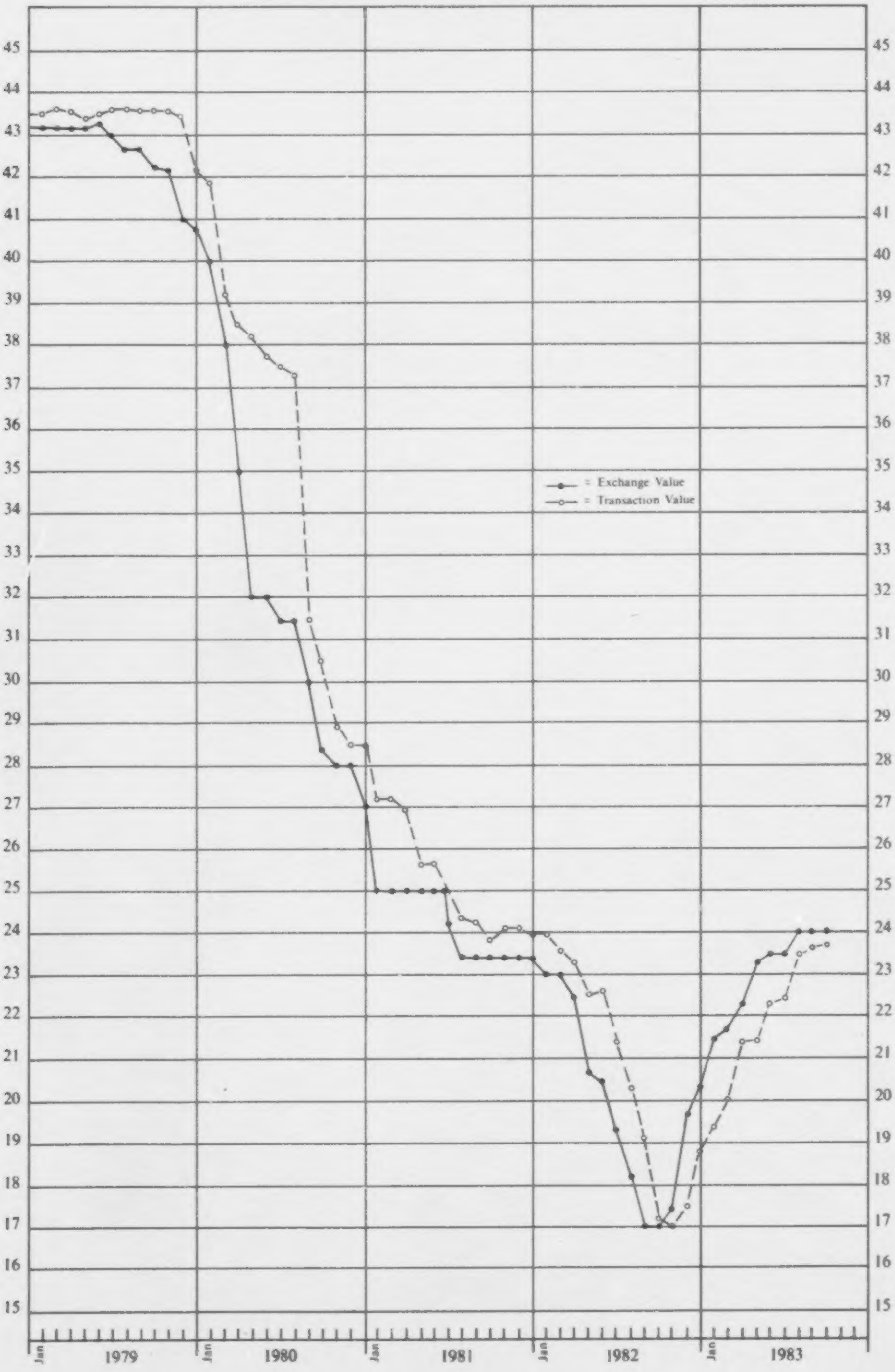
*HISTORICAL MARKET DATA*

## EXCHANGE AND TRANSACTION VALUES SINCE JANUARY 1979

Determined as of the last day of the month indicated



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*HISTORICAL MARKET DATA*

## HISTORICAL EXCHANGE VALUES

Determined as of the last day of the month indicated (US Dollars/lb. $U_3O_8$)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1968 | — | — | — | — | — | — | — | 6.35 | 6.35 | 6.40 | 6.45 | 6.50 |
| 1969 | — | 6.35 | 6.10 | 6.10 | 6.25 | 6.25 | 6.20 | 6.20 | 6.15 | 6.15 | 6.15 | 6.20 |
| 1970 | 6.30 | 6.30 | 6.30 | 6.30 | 6.30 | 6.30 | 6.30 | 6.20 | 6.15 | 6.15 | 6.15 | 6.15 |
| 1971 | 6.20 | 6.20 | 6.20 | 6.20 | 6.15 | 6.05 | 6.00 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 |
| 1972 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 | 5.95 |
| 1973 | 5.95 | 6.00 | 6.10 | 6.20 | 6.45 | 6.50 | 6.50 | 6.50 | 6.50 | 6.50 | 6.75 | 7.00 |
| 1974 | 7.70 | 7.90 | 8.00 | 9.00 | 9.50 | 10.50 | 11.50 | 12.00 | 12.50 | 14.00 | 14.75 | 15.00 |
| 1975 | 16.00 | 16.00 | 18.00 | 20.00 | 21.00 | 23.00 | 24.70 | 26.00 | 26.00 | 28.50 | 30.00 | 35.00 |
| 1976 | 35.20 | 37.00 | 39.25 | 40.00 | 40.00 | 40.00 | 40.00 | 40.40 | 41.00 | 41.00 | 41.50 | 41.00 |
| 1977 | 41.35 | 41.50 | 41.60 | 41.60 | 42.00 | 42.25 | 42.25 | 42.25 | 42.40 | 42.75 | 43.20 | 43.20 |
| 1978 | 42.90 | 43.25 | 43.25 | 43.25 | 43.40 | 43.40 | 43.40 | 43.10 | 43.25 | 43.00 | 43.25 | 43.25 |
| 1979 | 43.25 | 43.25 | 43.25 | 43.25 | 43.25 | 43.00 | 42.70 | 42.70 | 42.20 | 42.20 | 41.00 | 40.75 |
| 1980 | 40.00 | 38.00 | 35.00 | 32.00 | 32.00 | 31.50 | 31.50 | 30.00 | 28.50 | 28.00 | 28.00 | 27.00 |
| 1981 | 25.00 | 25.00 | 25.00 | 25.00 | 25.00 | 24.25 | 23.50 | 23.50 | 23.50 | 23.50 | 23.50 | 23.50 |
| 1982 | 23.00 | 23.00 | 22.50 | 20.75 | 20.50 | 19.25 | 18.25 | 17.00 | 17.00 | 17.50 | 19.75 | 20.25 |
| 1983 | 21.50 | 21.75 | 22.25 | 23.25 | 23.50 | 23.50 | 24.00 | 24.00 | **24.00** | | | |

## HISTORICAL TRANSACTION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. $U_3O_8$)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1976 | — | — | — | — | 39.60 | 39.70 | 39.70 | 40.40 | 40.30 | 40.60 | 40.70 | 40.70 |
| 1977 | 41.30 | 41.30 | 41.40 | 41.50 | 42.80 | 42.90 | 43.00 | 42.60 | 42.50 | 42.80 | 42.90 | 42.90 |
| 1978 | 43.10 | 43.30 | 43.70 | 43.60 | 43.60 | 43.20 | 43.30 | 43.40 | 43.40 | 43.60 | 43.40 | 43.70 |
| 1979 | 43.60 | 43.80 | 43.70 | 43.40 | 43.60 | 43.70 | 43.70 | 43.60 | 43.60 | 43.60 | 43.50 | 42.30 |
| 1980 | 42.00 | 39.30 | 38.60 | 38.40 | 37.90 | 37.60 | 37.30 | 31.60 | 30.60 | 29.00 | 28.70 | 27.70 |
| 1981 | 27.20 | 27.20 | 27.00 | 25.70 | 25.70 | 24.50 | 24.40 | 24.30 | 23.90 | 24.10 | 24.10 | 24.00 |
| 1982 | 24.00 | 23.70 | 23.40 | 22.60 | 22.70 | 21.50 | 20.30 | 19.10 | 17.30 | 17.00 | 17.55 | 18.80 |
| 1983 | 19.35 | 20.00 | 21.35 | 21.40 | 22.35 | 22.45 | 23.50 | 23.60 | **23.65** | | | |

## HISTORICAL CONVERSION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. $U_6$)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1981 | 1.20 | 1.20 | 1.20 | 1.40 | 1.15 | 1.15 | 1.15 | 1.10 | 1.10 | 1.10 | 1.20 | 1.20 |
| 1982 | 1.20 | 1.20 | 1.20 | 1.20 | 1.00 | 1.00 | 1.00 | 0.90 | 1.10 | 1.60 | 1.45 | 1.45 |
| 1983 | 1.20 | 1.40 | 1.40 | 1.20 | 1.20 | 1.20 | 1.10 | 1.10 | **1.00** | | | |

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*GOVERNMENT STATISTICS*

## AUSTRALIA

| | Price Index of Materials Used in Manufacturing Industry—All Groups (Year 1968-69 = 100.0)[1] | Award Rates of Pay Indexes Australia—Adult Males In Mining Wage Earners, Weekly Rates (Year 1976 = 100.0)[2] |
|---|---|---|
| Annual Avg. 1972[3] | 105.6 | 71.26 |
| Annual Avg. 1973[3] | 124.4 | 78.96 |
| Annual Avg. 1974[3] | 141.9 | 108.07 |
| Annual Avg. 1975[3] | 150.4 | 132.55 |
| Annual Avg. 1976[3] | 168.4 | 160.93 |
| Annual Avg. 1977[3] | 192.0 | 179.03 |
| Annual Avg. 1978[3] | 198.5 | 190.04 |
| Annual Avg. 1979 | 248.8 | 196.34 |
| Annual Avg. 1980 | 321.8 | 218.00 |
| Annual Avg. 1981 | 355.3 | 237.34 |
| Annual Avg. 1982 | 368.5 | 174.88 |
| May 1982 | 367.6 | 171.9 |
| Jun 1982 | 367.8 | 173.2 |
| Jul 1982 | 370.0 | 177.2 |
| Aug 1982 | 372.5R | 178.2 |
| Sep 1982 | 375.2 | 178.4 |
| Oct 1982 | 378.4 | 178.4 |
| Nov 1982 | 375.8 | 178.5 |
| Dec 1982 | 375.0 | 179.5 |
| Jan 1983 | 386.9 | 179.6 |
| Feb 1983 | 388.6 | 179.5 |
| Mar 1983 | 398.7 | 179.4 |
| Apr 1983 | 410.2 | 179.7 |
| May 1983 | 417.1 | 179.8 |
| Jun 1983 | — | 179.9 |
| Jul 1983 | — | 179.5P |

P = Preliminary R = Revised since last month

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[1] Australian Bureau of Statistics, Canberra: "Price Index of Materials Used in Manufacturing Industry" (Catalogue No. 6411.0), Table 3.

[2] Australian Bureau of Statistics, Canberra: "Award Rates of Pay Indexes, Australia" (Catalogue No. 6312.0), Table 8. Figures for the latest fourteen months shown are subject to revision.

[3] Monthly data for 1970 through 1978 appear on pages 4.7 and 4.8 of Nuexco Report 138.

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## CANADA

| | Industry Selling Price Index: Manufacturing (D 500000)[1] [2] (1971 = 100.0) | Wage-earner Data: Average Hourly Earnings (C$)[4] [5] | | | | |
|---|---|---|---|---|---|---|
| | | Metal Mining, including Milling (SIC 050-099)[3] | Primary Metal Industries, non-ferrous (SIC 296) | Primary Metal Industries, non-ferrous (SIC 296-298)[6] | Primary Metal Industries, non-ferrous (SIC 298) | Chemicals and Chemical Products (SIC 372-379)[7] |
| Annual Avg. 1979 | 217.9 | 9.66 | — | 7.35 | — | 7.67 |
| Annual Avg. 1980 | 247.2 | 10.80 | — | 8.05 | — | 8.50 |
| Annual Avg. 1981 | 288.7 | 12.23 | — | 9.03 | — | 9.53 |
| Annual Avg. 1982 | 288.8 | 13.92 | — | 9.98 | — | 10.63 |
| Jun 1982 | 289.7 | 13.83 | — | 9.92 | — | 10.69 |
| Jul 1982 | 290.3 | 14.02 | — | 10.05 | — | 10.73 |
| Aug 1982 | 290.3 | 14.23 | — | 10.03 | — | 10.80 |
| Sep 1982 | 292.4 | 14.01 | — | 10.18 | — | 10.73 |
| Oct 1982 | 292.1 | 13.89 | — | 10.18 | — | 10.86 |
| Nov 1982 | 291.3 | 14.28 | — | 10.43 | — | 10.90 |
| Dec 1982 | 292.3 | 14.32 | — | 10.55 | — | 11.06 |
| Jan 1983 | 292.7R | 14.35 | — | 10.72 | — | 11.06 |
| Feb 1983 | 293.5 | 14.28 | — | 10.74 | — | 11.06 |
| Mar 1983 | 295.2 | 14.48 | — | 10.93 | — | 11.21 |
| Apr 1983 | 297.1 | 14.13 | 11.57 | — | 10.10 | 11.02R |
| May 1983 | 298.5 | 14.10R | 11.39 | — | 9.82 | 10.97 |
| Jun 1983 | 299.2 | 14.07R | 11.33R | — | 9.84R | 11.05P |
| Jul 1983 | 300.1 | 13.91P | 11.65 | — | 10.29P | 11.04P |
| Aug 1983 | 300.7 | — | — | — | — | — |

P = Preliminary    R = Revised since last month

[1] Statistics Canada, Prices Division, Ottawa: "Industry Price Indexes" (Catalogue 62-011), Table 1. Indexes for the most recent six months shown are subject to revision.

[2] Monthly data for 1973 through 1978 appear on page 4.10 of Nuexco Report 138.

[3] The wage earner series in Nuexco reports prior to March 1983 was Metals (SIC 050-059).

[4] Statistics Canada, Labour Division, Employment and Payrolls Section, Ottawa: "Employment, Earnings and Hours" (Catalogue 72-002), Table 2.

[5] Monthly data for 1977 and 1978 appear on page 4.11 of Nuexco Report 138.

[6] Beginning with the April 1983 figure, Primary Metal Industries, non-ferrous is split into SIC 296 and SIC 298.

[7] Chemical and Chemical Products prior to April 1983 was SIC 370-379. The new series is from a new survey which includes all companies and is based on a 1970 classification. The old survey included companies of 20 employees or more.

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*GOVERNMENT STATISTICS*

## REPUBLIC OF SOUTH AFRICA

| | Average Declared Working Costs per Metric Ton of Gold Ore Milled (Rand)[1] | Consumer Price Index[2] (1975 = 100, except where otherwise indicated) | Producer[5] Price Index All Groups (1975 = 100) | Total Employment in Mining and Quarrying (Code 35)[7] | Total Salaries and Wages in Mining and Quarrying (1,000 Rand) (Code 40)[7] |
|---|---|---|---|---|---|
| Annual Avg. 1972[3] | 8.79 | 113.3[4] | 63.9 | 623,067 | 443,933 |
| Annual Avg. 1973[3] | 10.51 | 124.1[4] | 72.3 | 684,743 | 572,133 |
| Annual Avg. 1974[3] | 13.18 | 138.5[4] | 85.3 | 674,140 | 761,596 |
| Annual Avg. 1975[3] | 16.71 | 157.2[4] | 100.0 | 639,473 | 1,003,617 |
| Annual Avg. 1976[3] | 19.30 | 174.7[4] | 115.1 | 671,240 | 1,212,983 |
| Annual Avg. 1977[3] [6] | 23.87 | 194.4[4] | 130.0 | 712,006 | 1,420,670 |
| Annual Avg. 1978[3] [6] | 27.14 | 137.2 | 142.7 | 664,571 | 1,537,169 |
| Annual Avg. 1979[3] [6] | 30.18 | 155.3 | 164.5 | 692,209 | 1,830,632 |
| Annual Avg. 1980[6] | 35.53 | 176.7 | 192.1 | 714,379 | 2,279,615 |
| Annual Avg. 1981 | 41.89 | 206.5 | 218.3 | 728,506 | 2,820,505 |
| Annual Avg. 1982 | 47.25 | 233.5 | 248.7 | 707,552 | 3,246,071 |
| Mar 1982 | 45.49 | 225.2 | 237.4 | 725,700 | 262,210 |
| Apr 1982 | — | 228.9 | 241.9 | 707,502 | 252,562 |
| May 1982 | — | 230.3 | 244.8 | 715,162 | 258,770 |
| Jun 1982 | 45.77 | 232.1 | 246.7 | 707,552 | 261,361 |
| Jul 1982 | — | 234.1 | 249.4 | 702,141 | 283,248 |
| Aug 1982 | — | 236.8 | 253.4 | 705,562 | 276,730 |
| Sep 1982 | 48.04 | 241.0 | 255.0 | 704,344 | 282,782 |
| Oct 1982 | — | 243.9 | 260.1 | 701,316 | 285,328 |
| Nov 1982 | — | 245.4 | 262.5 | 707,966 | 287,699 |
| Dec 1982 | 49.62 | 246.2 | 263.0 | 683,982 | 288,019 |
| Jan 1983 | — | 249.0 | 264.9 | 688,030 | 289,075 |
| Feb 1983 | — | 253.1 | 267.4 | 697,089 | 281,413 |
| Mar 1983 | 50.35 | 255.9 | 269.1 | 695,976 | 290,586 |
| Apr 1983 | — | 257.8 | 270.9 | 697,158 | 286,708 |
| May 1983 | — | 259.7 | 274.1 | 701,712 | 295,701 |
| Jun 1983 | 50.51 | 260.8 | 273.1 | 706,933 | 300,177 |
| Jul 1983 | — | 262.5 | 273.7 | — | — |
| Aug 1983 | — | 265.6 | — | — | — |

---

[1] Chamber of Mines of South Africa, Johannesburg: "Analysis of Working Results," published quarterly. The tonnage-weight index of average working costs per metric ton of gold ore milled for 1983 is as follows. (Base: March quarter 1982 = 100). See Nuexco report #178 page 24 for the tonnage-weighted index for 1982. Description and calculation of the index is on page 16 of Nuexco report #178.

| | | |
|---|---|---|
| 1983: | January-March | 111.2 |
| | April-June | 111.9 |

[2] Republic of South Africa Department of Statistics, Pretoria; "Government Gazette: Consumer Price Index for Urban Areas."

[3] Historical data for the Average Declared Working Costs and Consumer Price Index 1970-1979 appear on page 4.9 of Nuexco Report 140.

[4] April 1970 = 100.00.

[5] Previously known as the WHOLESALE PRICE INDEX, now the PRODUCER PRICE INDEX. The computation remains the same.

[6] Historical data for Codes 35 and 40 1977-1980 appear on page 28 of Nuexco Report 157.

[7] Bulletin of Statistics, Department of Statistics, Pretoria.

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## UNITED STATES

| | Producer Price Index— Industrial Commodities (1967 = 100)[1] | Producer Price Index— All Commodities (1967 = 100)[1] | Consumer Price Index (1967 = 100)[2] | GNP Implicit Price Deflator (1972 = 100)[3] | Gross Average Hourly Earnings of Production or Non-supervisory Workers (US$)[4] | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Metal Mining (SIC 10) | Primary Non-ferrous Metals (SIC 333) | Chemicals and Allied Products (SIC 28) | Electric and Electronic Equipment (SIC 36) |
| Annual Avg. 1972[5] | 117.9 | 119.1 | 125.3 | 100.00 | 4.56 | 4.59 | 4.26 | 3.71 |
| Annual Avg. 1973[5] | 125.9 | 134.7 | 133.1 | 105.75 | 4.84 | 4.98 | 4.51 | 3.91 |
| Annual Avg. 1974[5] | 153.8 | 160.1 | 147.7 | 115.08 | 5.44 | 5.63 | 4.88 | 4.21 |
| Annual Avg. 1975[5] | 171.5 | 174.9 | 161.2 | 125.79 | 6.13 | 6.24 | 5.39 | 4.64 |
| Annual Avg. 1976[5] | 182.4 | 183.0 | 170.5 | 132.34 | 6.76 | 6.87 | 5.91 | 4.96 |
| Annual Avg. 1977[5] | 195.1 | 194.2 | 181.5 | 140.05 | 7.28 | 7.67 | 6.43 | 5.39 |
| Annual Avg. 1978[5] | 209.4 | 209.3 | 195.4 | 150.42 | 8.23 | 8.56 | 7.02 | 5.82 |
| Annual Avg. 1979[5] | 236.5 | 235.6 | 217.4 | 163.42 | 9.27 | 9.50 | 7.60 | 6.32 |
| Annual Avg. 1980[5] | 274.8 | 268.8 | 246.8 | 178.64 | 10.26 | 10.63 | 8.30 | 6.94 |
| Annual Avg. 1981 | 304.1 | 293.4 | 272.4 | 195.51 | 11.55 | 11.98 | 9.12 | 7.62 |
| Annual Avg. 1982 | 312.3 | 299.3 | 289.1 | 207.15 | 12.33 | 12.94 | 9.96 | 8.21 |
| Aug 1982 | 313.2 | 300.2 | 292.8 | — | 12.29 | 13.01 | 10.01 | 8.30 |
| Sep 1982 | 312.7 | 299.3 | 293.3 | 208.51 | 12.53 | 13.51 | 10.19 | 8.37 |
| Oct 1982 | 314.3 | 299.8 | 294.1 | — | 12.51 | 13.26 | 10.22 | 8.41 |
| Nov 1982 | 315.0 | 300.3 | 293.6 | — | 12.53 | 13.22 | 10.26 | 8.45 |
| Dec 1982 | 315.2 | 300.7 | 292.4 | 210.00 | 12.53 | 13.05 | 10.32 | 8.51 |
| Jan 1983 | 313.9 | 299.9 | 293.1 | — | 12.63 | 13.33 | 10.34 | 8.53 |
| Feb 1983 | 313.9 | 300.9 | 293.2 | — | 12.66 | 13.29 | 10.41 | 8.56 |
| Mar 1983 | 313.5 | 300.6 | 293.4 | 212.83 | 12.48 | 13.35 | 10.39 | 8.60 |
| Apr 1983 | 312.4R | 300.6R | 295.5 | — | 12.67 | 13.34 | 10.43 | 8.60 |
| May 1983 | 313.8 | 301.7 | 297.1 | — | 12.55 | 13.62 | 10.50 | 8.60 |
| Jun 1983 | 315.4 | 302.5 | 298.1 | 214.55R | 12.66R | 13.38R | 10.52R | 8.63R |
| Jul 1983 | 316.6 | 303.2 | 299.3 | — | 12.70P | 13.54P | 10.56R | 8.68R |
| Aug 1983 | 317.5P | 304.9P | 300.3P | — | — | — | 10.59P | 8.59P |

P = Preliminary      R = Revised since last month

[1] US Bureau of Labor Statistics, Washington, D.C.: "Producer Prices and Price Indexes," Table 6 (formerly "Wholesale Prices and Price Indexes"). Producer Price Indexes are revised four months after they are first released to reflect the availability of late reports and corrections by respondents.

[2] US Bureau of Labor Statistics, Washington, D.C.: Consumer Price Index for All Urban Consumers, US City Average, All Items.

[3] US Department of Commerce, Washington, D.C.: Bureau of Economic Analysis, National Income and Wealth Division: "Survey of Current Business," Table 7.1. The GNP Implicit Price Deflator is published quarterly, and seasonally adjusted.

[4] US Bureau of Labor Statistics, Washington, D.C.: "Employment and Earnings," Table C-2. All data based on 1972 revision of SIC Manual. Data for 1970-1976 are adjusted to the March 1977 benchmark. Data for 1977-1978 are adjusted to the March 1979 benchmark. Data for January 1979 and beyond are adjusted to the March 1980 benchmark

[5] Monthly data 1970-1978 for Producer Price Index-Industrial Commodities, Consumer Price Index, and Employment and Earnings SIC codes 10, 333, and 28, and quarterly data for GNP Implicit Price Deflator appear on pages 4.6-4.8 of Nuexco Report 139.
Monthly data 1977-1978 for Employment and Earnings SIC Codes 10, 333, and 28 appear on page 33 of Nuexco Report 147.
Monthly data 1970-1978 for Employment and Earnings SIC Code 36 appear on page 23 of Nuexco Report 154.
Monthly data 1979-1980 for Employment and Earnings, Revised Establishment Data, all listed codes, appear on page 22 of Nuexco Report 158.
Monthly data 1977-1980 for Producer Price Index-All Commodities, appear on page 21 of Nuexco Report 158.

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# MEGATRENDS IN NUCLEAR FUEL: APPROACHING A NEW ERA

By

**J. R. Wolcott**
Chairman
Nuexco

Presented To:

**Fourth Pacific Basin Nuclear Conference**

Vancouver, British Columbia
September 12, 1983

## MEGATRENDS IN NUCLEAR FUEL: APPROACHING A NEW ERA

By: J. R. Wolcott
Chairman
Nuexco

### Introduction

The nuclear power industry as a whole has had a stormy decade, and the fuel side has been jolted by shockwaves. Prices rose and fell sharply; supply and demand became far out of balance; mines dependent on high prices suffered closures, while new high-grade deposits were developed. The United States reduced production by two-thirds within a few years. The epicenter of Canadian production moved west.

Although the problems of the past decade have not fully receded, there are signs that much of the shock has been absorbed and that the next decade will be calm by comparison. Within four or five years the uranium industry may achieve improved and welcome stability. Today the excess of production over consumption is not so huge as it was in recent years; prices are improving and market changes are not violent. The worst is probably behind us.

I do not mean to suggest the end of uncertainties. But the controlling variables are stabilizing. Estimates of future consumption and production have a much more solid basis today than they had ten years ago.

### Consumption

I expect actual consumption in 1990 to fall within 10% of our current Nuexco forecasts. That statement would be ridiculous if the variables confronting a forecaster today were as uncertain as they were 10 years ago.

A consumption forecast depends mainly on the projection of fuel needs for three categories: reactors in operation; reactors under construction; and anticipated orders. A twenty-year forecast prepared in 1973 depended overwhelmingly on anticipated orders, less on projects in progress, and least on plants in operation. The largest component, anticipated orders, was the most speculative. Least speculative was the smallest component, plants in operation.

Today the situation is completely reversed. The largest component is the least speculative, plants in operation. We know a great deal about the needs and timing of units that are operating or are approaching completion. The smallest component to consider today is anticipated orders: there will probably be none in the United States significantly affecting uranium consumption by the year 2000. Outside the US the number of orders requiring uranium before the year 2000 will be on the order of 35 to 40. Uranium to service those units will approximate 15 million pounds $U_3O_8$ per year, some 15% of current production levels.

The modestly predictable conditions of today will steadily become more predictable as new plants go into operation. For example, the US has 76 units in operation and another 65 under construction. More than half of those under construction are more than 50% complete. The fact that approximately 120 units will be in operation by 1990 is the single overriding factor in any US consumption forecast.

Of course, operating plants have technical variables that must be considered in any consumption assessment: capacity factor, availability, tails assays, and technical improvements in fabrication all have influence; but their importance is small when compared to plant cancellations, schedule delays, and electrical load growth variations.

### Production

A decade ago the uranium production industry was driven by speculation that nuclear fuel demand was on the verge of long-term rapid growth. Utilities prompted this assumption by ordering uranium and stockpiling inventory for plants which in many cases failed to materialize. The US government artificially promoted domestic production with an import embargo and with enrichment policies that forced feed deliveries in advance of true need. New and marginally competitive producers saturated the market. Even though US reactor orders virtually ceased in 1974, US yellowcake production continued to grow. A peak of 43 million pounds in 1980 was reached, six years after the pace of new orders had almost stopped and the epidemic of plant cancellations had begun.

Nevertheless, the precipitous decline was to startle many users and producers. The lower demand became fully apparent only in the aftermath of the TMI accident and the worldwide recession caused by oil prices. The virtual standstill of the nuclear power industry made the supply excess obvious.

Mineral economics had a major impact on the production industry. Discoveries in Western Canada made available ore grades 10 to 20 times higher than those found in most active US mines. Australian deposits were also several times the average US ore grade. As the US import

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embargo was phased out, a large portion of the previously protected US industry came into competition with strongly-based foreign producers.

The present world production situation may be described as follows:

*First*, the United States has passed through a period during which much uneconomic and marginal production capacity was swept away. The 1980 US output of 43 million pounds was twice the domestic consumption rate. Unable to compete with low-cost producers in the export market, US producers have cut back to a rate of 16 million pounds per year, which is about half the present domestic consumption rate. Most of that which remains has been economically tested. The current annual level will probably decrease slightly next year, but then recover to a higher level during the remainder of the decade. Utility preference for domestic supply will lend support to US producers.

*Second*, Western Canada is developing its high-grade orebodies in Saskatchewan on a scale that will be difficult to match. The projected annual production rate there of 20 million pounds stands firm like the "Rock of Gibraltar" of the uranium world.

Eastern Canada is producing more than 10 million pounds per year, but is more vulnerable to competition. While long-term contracts have a stabilizing influence, pressure is building to reduce quantities and prices. Eastern Canada does not have the strong underpinning of low-cost resources that Western Canada enjoys.

*Third*, South Africa will continue to produce over 15 million pounds per year, 15% of world production. The low cost of uranium-gold by-product or co-product operations places South Africa in an enviable competitive position.

*Fourth*, Namibia produces 10 million pounds per year, 10% of world output, from the giant open-pit Rossing Mine. Economics are favorable, although perhaps not as favorable as for some mines with higher-grade ore. Namibia's economy has a great need for foreign exchange. Social and political disruptions will not necessarily interfere with the export of uranium.

*Fifth*, Gabon and Niger provide approximately 10% of world production. Costs are less favorable than those of other regions, production is largely captive to the French nuclear power porgram, and substantial cutbacks should be expected

*Sixth*, ERA and Queensland Mines in Australia, together exporting 10% of world production, possess a combination of ore grades and investment that appears to be economically secure.

Total annual production from the most economically secure regions—Western Canada, South Africa and Australia—is about 45 million pounds, or approximately 45% of world production. The group at the next level—Namibia, the United States and Eastern Canada—adds another 35 million pounds, or 35% of world production. These two groups with a high-to-moderate degree of economic security provide 80% of annual production. They have an excellent chance of providing that percentage well into the next decade.

**Governments**

Virtually every decision by users and producers involves an estimate of what governments have done or will do. At present, major government concerns are: (1) Australian restraints on development; (2) the potential for a US import embargo; (3) reactions to South African apartheid; and (4) Canadian marketing policies, such as the upgrading requirement.

Australia is puzzling. The government's position reminds me of Winston Churchill's description of Russia in October of 1939—"a riddle wrapped in a mystery inside an enigma." The forces inside the Australian government appear to be more complex than we distant outsiders can readily comprehend.

Nevertheless, I believe that economic pragmatism will ultimately prevail. While short-term Australian expansion appears unlikely, a termination of that production already underway also appears unlikely. As it will be difficult to attract new long-term customers or foreign investment until confidence in government policy is reestablished, production will probably remain at or near the present level for a number of years.

The probability of an effective US import embargo is low. Special interests continue to promote the idea; however, an embargo on foreign uranium probably would not make it through the legislative process on its own merits. Nonetheless, an embargo *could* be enacted as an amendment to more prized legislation. Granted that element of uncertainty, I still believe a really meaningful embargo will not pass the Congress.

South Africa's apartheid problem has no parallel for political and social complexity: criticism is abundant and practical solutions are scarce. The variety of group and tribal interests within South Africa places a special premium on economic continuity. The likelihood that export of gold and uranium will be interrupted is small.

The Canadian government favors uranium production

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and exports and has contributed to the success of domestic producers. A potentially prohibitive policy of the government is the requirement that all domestic production be upgraded to $UF_6$ in Canada, but thus far that policy appears to have damaged business little. In any case, government policy probably will not cause any long-term interruption of exports.

Based on this general appraisal of politics in uranium producing nations, I do not see on the horizon much likelihood of government-caused alterations of the world's uranium megatrends.

### Balancing Consumption and Production

I can paint, as I just have, a picture of emerging consumption stability on the one hand, and of developing production stability on the other, but other conditions are necessary for the achievement of dynamic market equilibrium. The most important conditions are: (1) adequate information, (2) a secondary market, (3) production buffers, and (4) calm psychology.

*Information*—A decade ago, market dynamics were inadequately understood. The flow of information between buyers and sellers was sparse, and romantic expectations had more influence than did objective analysis. Nowadays, utilities will not contract for large quantities of unneeded supplies; an inflated enrichment contract demand no longer stimulates excess uranium production; and the role of governments is fully appreciated.

*Secondary Market*—A secondary market has always existed, but its use has usually lagged the need. Consequently, imbalances developed to a point where redistributions produced severe jolts. More recently, the secondary market has been relieving existing stresses more rapidly than new stresses are developing, so that the overall market imbalance is subsiding.

*Production Buffers*—As the various forces pushed production to its limits throughout the 1970s, small demand increases unduly accelerated price. That is no longer the case. South Africa could absorb another five million pounds of demand quickly, and Canada could do likewise. An increase of $10 to $15 in price could elicit another 10 million pounds of production from the US. Today, the industry's adaptability is such that even a major loss, such as Australia's total withdrawal from the market, could be absorbed without catastrophic perturbations. Moreover, utility inventories are of a size that makes them important surge tanks in the system.

*Psychology*—The belief once prevailed that production growth could not keep pace with consumption growth, that we could run out of uranium within a few decades, and that prices would skyrocket. A psychology developed that encouraged advance buying, utility investments in production, and conservative long-term contracts. Today, most buyers assume rightfully that uranium will be available at affordable prices. A relatively calm psychological atmosphere prevails.

### Conclusions

The cycle of development for businesses of all types is that there is first an *innovative* phase, as an industry emerges; then a *growth* phase, as use expands; then a *shakedown* phase, during which marginal participants fall by the wayside as the strong prevail. And finally there is a *mature* phase, in which the strong provide stability.

I believe the uranium business is in the latter stages of the shakedown phase. We remain separated from the mature phase by: (1) the remaining inventory problem; (2) some further shaking out that might take place in eastern Canada; and (3) potential consolidation in Central Africa. The imbalance in supply and demand is less of a problem and inventory redistribution is underway via the secondary market.

I do not mean to suggest that all uncertainties will disappear. My message is that the controlling set of variables is changing and their range of uncertainty is narrowing. Nor do I mean to suggest that all the problems of the industry will be suddenly or permanently solved in the mature phase. But I do believe that firming demand, firming production, and the much higher level of sophistication in all quarters of the industry will make for a more stable, profitable, and less frustrating business. We have to be sure that our plans and policies are not designed to prepare us for the last war. The look ahead is different and—I think—a more enjoyable one for all.

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| NUEXCO REPORT 182<br>FIGURES OF THE MONTH<br>(September 30, 1983) | This Month (Report 182) | Last Month (Report 181) | 12 Months Ago (Report 170) |
|---|---|---|---|
| Exchange Value[1] | 24.00 | 24.00 | 17.00 |
| Transaction Value[1] | 23.65 | 23.60 | 17.30 |
| Conversion Value[2] | 1.00 | 1.10 | 1.10 |
| Loan Use Charge Rate[3] | 6% | 6% | 6% |
| Near-Term Uranium Supply[4] | 7.2 | 6.7 | 3.3 |
| Near-Term Uranium Demand[5] | 4.4 | 2.4 | 0.66 |
| Near-Term Supply-Demand Ratio | 1.7 | 2.9 | 5.0 |
| Recent Uranium Sales: | | | |
| Number of Transactions[6] | 2 | 9 | 7 |
| Quantity of Material[7] | 0.1-0.35 | 1.8-3.9 | 0.8-2.0 |
| Nuexco SWU Value: | | | |
| FY 84 | 90.0 | 95.0 | — |
| USDOE SWU Prices: | | | |
| AFC | 138.65 | 138.65 | 138.65 |
| Requirements | 149.85 | 149.85 | 149.85 |
| Market Value of Enriched $UF_6$[9] [10]: | | | |
| 2.5 w/o $U_{235}$ | 582.75 | 598.47 | — |
| 3.0 w/o $U_{235}$ | 743.24 | 764.27 | — |
| 3.5 w/o $U_{235}$ | 906.43 | 932.90 | — |
| 4.0 w/o $U_{235}$ | 1,071.62 | 1,103.64 | — |

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[1] US $ per pound $U_3O_8$ equivalent

[2] US $ per pound U as $UF_6$

[3] Per annum

[4] Active inquiries to sell, for delivery within 12 months after contract signing (millions of pounds $U_3O_8$)

[5] Active inquiries to purchase, for delivery within 12 months after contract signing (millions of pounds $U_3O_8$).

[6] Uranium sales only; does not include loans, conversion, or SWU transactions.

[7] Millions of pounds $U_3O_8$, equivalent.

[8] US $ per SWU.

[9] Calculated using the Nuexco Exchange Value, Conversion Value, and 0.20 percent tails assay. Calculations before 2/28/83 used the USDOE price for AFC SWUs. As of 2/28/83, calculations use the Nuexco SWU Value for the relevant fiscal year (currently FY 84).

[10] US $ per KgU as $UF_6$.

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# EXECUTIVE SUMMARY
## REPORT 182

| | |
|---|---|
| **Exchange Value<br>$24.00, unchanged** | The **Exchange Value** as of September 30, 1983 is **$24.00** per pound $U_3O_8$, unchanged from last month. Two uranium sales transactions are reported, involving approximately 260 million pounds $U_3O_8$ *equivalent*. One transaction involved $U_3O_8$ and one involved $UF_6$. |
| **Supply-Demand Ratio<br>Fell to 1.7:1** | **Active** spot and near-term **uranium supply** amounts to **7.2** million pounds $U_3O_8$, *equivalent*, up 500 thousand pounds from last month. **Active** spot and near-term **uranium demand** rose 83 percent, to **4.4** million pounds $U_3O_8$ equivalent. Therefore, the spot and near-term **supply-demand ratio** fell to **1.7:1.** |
| **Transaction Value Rose<br>$.05, to $23.65** | The **Transaction Value** as of September 30, 1983, is **$23.65** per pound $U_3O_8$. It includes 21 transactions involving a total of 2.0 million pounds equivalent $U_3O_8$ and covers a period of six months. |
| **Loan Use Charge Rate<br>unchanged at 6%** | The **Loan Use Charge Rate** as of September 30, 1983 is **6 percent** per annum. The entry of some new supply to the market in September is causing slight downward pressure on the loan rate, but no uranium loan transactions are reported. |
| **Conversion Value<br>decreased to $1.00** | The **Conversion Value** as of September 30, 1983 is **$1.00** per pound U as $UF_6$, down $0.10 since last month. One secondary market conversion transaction is reported, involving 101-300 thousand pounds U as $UF_6$. Active supply has declined to approximately three times active demand. The Conversion Value definition was clarified this month to exclude costs associated with unusual transportation requirements. |
| **SWU Value for FY84<br>$90, down $5** | The SWU Value as of September 30, 1983 is **$90 per SWU,** down $5 since last month. The new price reflects aggressive offers to sell large quantities of Eurodif-origin SWUs. Spot and near-term demand for secondary market enrichment services amounts to 1.4 million SWUs; spot and near-term supply amounts to 1.7 million SWUs. This issue reports three sales of enrichment services, involving a total of 200 thousand USDOE-origin SWUs. |
| **Enrichment** | DOE's Interim Sales Contract has caused some thinning of the secondary SWU market, but the large number of utilities that have not signed it continue to represent significant market potential. |
| **Canada** | The Canadian government will leave its uranium export policy virtually as is. Some CANDU reactors have suffered unaccustomed operating problems. |
| **Japan** | Japan's utilities set successive records for power generation this summer while simultaneously their 24 commercial reactors established a new record for availability. |
| **Spain** | Two new PWRs have joined the grid and Almaraz 1 is operational again. |
| **United States** | The long-awaited Oak Ridge meeting at which DOE is to unveil the new Utility Services enrichment contract has been delayed again, and the delay has given rise to some interesting questions. |
| **Commentary** | DOE's customers should understand clearly the DOE cost structure prior to making significant decisions on future enrichment services. |
| **Analysis & Commentary** | This Report summarizes the terms and conditions of six DOE enrichment contract types. |
| **Analysis & Commentary** | Nuexco's current forecasts of nuclear electric generating capacity, uranium consumption, production and supply-demand balance indicate that an unprecedented degree of stability lies ahead. |
| **Analysis & Commentary** | This Report describes the organizational structure of the Federal Energy Regulatory Commission, the US government's most powerful utility regulatory body. |
| **Raw Materials** | Cogema produces approximately one third of annual French domestic production from structurally formed sedimentary basins in the Lodeve district of southern France. |

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